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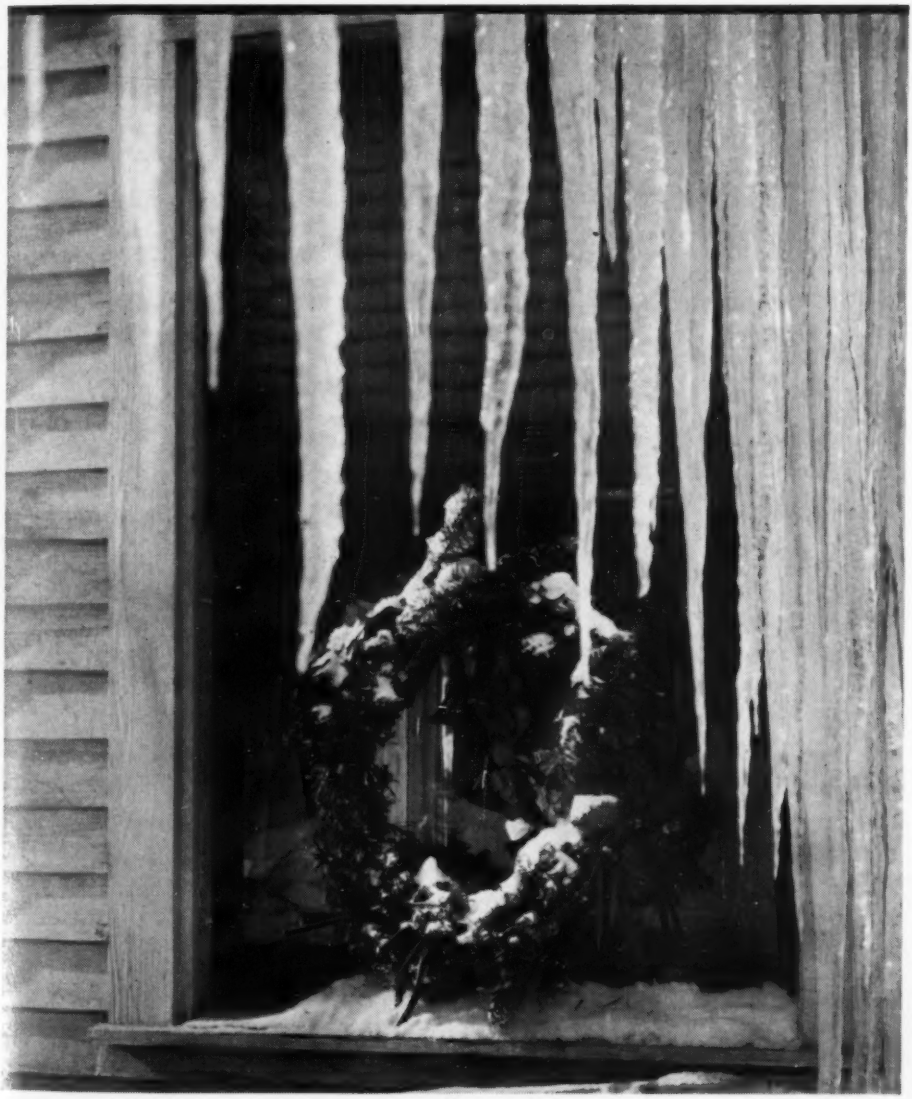

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Better Crops with PLANT FOOD

The Whole Truth—Not Selected Truth

R. H. STINCHFIELD, *Editor*

Editorial Office: 1155 16th Street, N. W., Washington 6, D. C.

VOLUME XXXIII NO. 10

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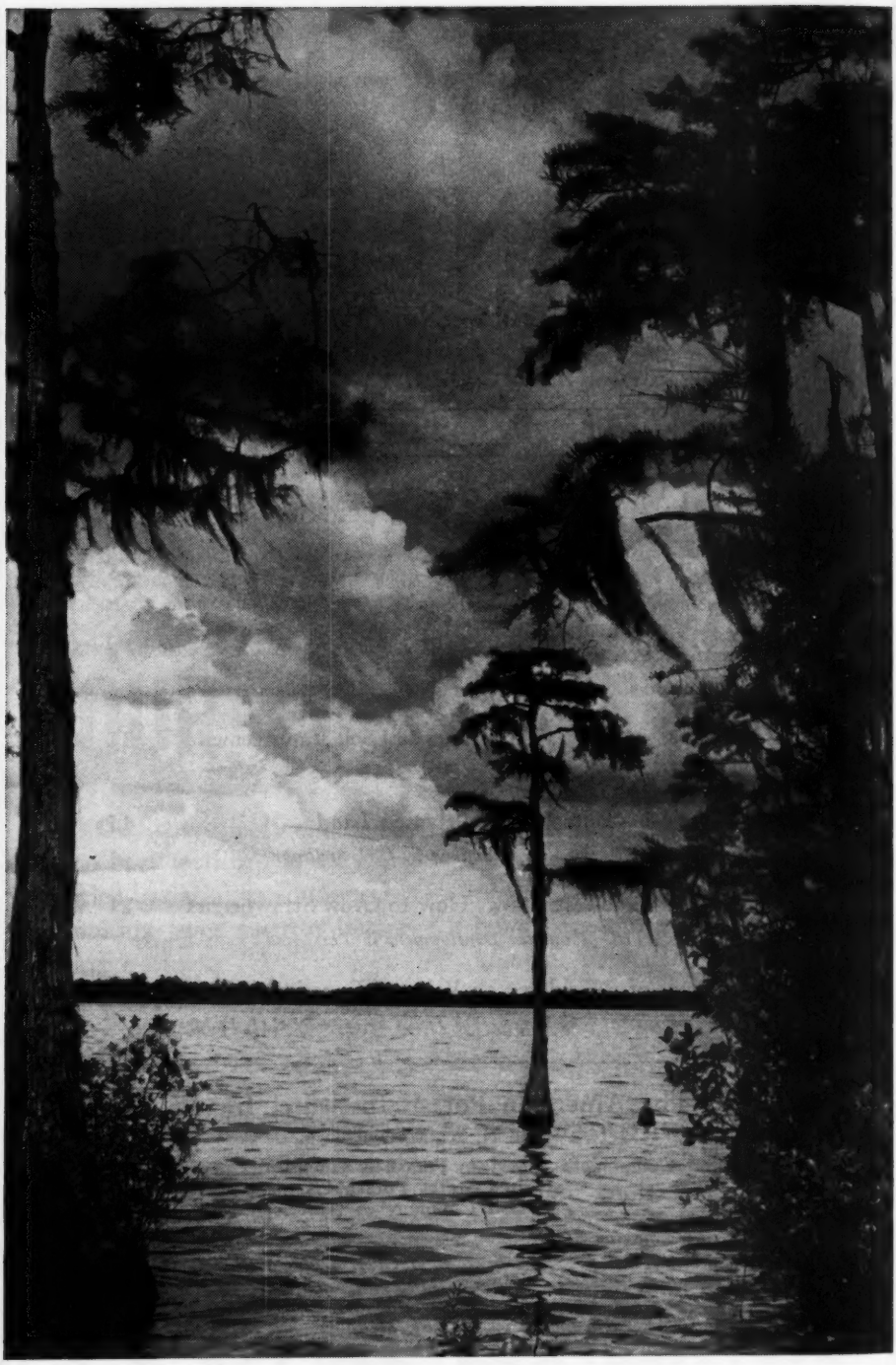

Christmas in Southern Waters

Better Crops with PLANT FOOD

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VOL. XXXIII WASHINGTON, D. C., DECEMBER 1949 No. 10

Let's Spread . . .

Good Will

Jeff McDermid

AROUND the happy Christmas circle our thoughts turn in customary ways to matters of good will. This seems to be a good time for us to give credit to folks with good will who have helped us to get along better during life's ups and downs, and whose example has perhaps served at times to increase and invigorate our own stock of that precious commodity.

It isn't necessary to confine our text to the Christmas story in the scriptures when we refer to good will. I recall no less a philosopher than Paul in the course of one of his numerous letters to outlying brethren said, in effect, that everyone of us owes a debt—not only to the Greeks, but to the Barbarians; and likewise both to the wise and the unwise.

Now this is right up my alley, and I thank Paul for giving us a theme which has so much truth in it. I'm no preacher, nor am I the son of a preacher; and none of my relatives ever occupied a pulpit—if I exclude a second cousin of old times, who rode horseback on rural circuits in Michigan. Therefore, I am not exactly qualified or ordained to sermonize, and it's not my purpose to thump any text or stamp and rant around or convert anybody to my way of thinking exclusively.

So when Paul points out that all of us owe a debt to somebody else, and

often to a throng of people that we never saw or ever thought about, he comes close to what I try to express in connection with men of good will.

After a spell of hard thinking—which taxes me no end—I believe that our welfare depends on developing and sustaining men of good will. That doesn't mean going in strong for "do-gooding" as a pretense or a profession, because some of the uplift gentry I've met up with don't act natural in such a borrowed role. Neither is it necessary for men of good will to submit the seats of their breeches to swift and frequent kicks without any protest; or for them to sit off in a corner and be backward and shy about telling the things they stand for.

To begin with, I believe that a guy who sticks to his job, wherever he is and whatever he does, and plugs along with the public interest at heart and pride in a task well done, is a benefactor and a good-will apostle. Countless folks away off yonder beyond the blue hills who never heard a word about this workman are in for a little bit of benefit and happiness from this chap's steadfast ways.

YOUR farmer, for example, who grows quality produce or makes his herd produce clean milk regularly —he's a purveyor of lots of useful good will, and what he turns off in that way gives plenty of satisfaction to hundreds of consumers who will never know him from green apples. It is even believed in soils laboratories that when a good farmer takes extra care of his land and gives it a dressing of plant food often enough in balanced fashion, that the food he eventually produces from such soil will be a heap better medicine for what ails folks than though it was harvested from weak, sickly, unbalanced acres.

There are many critics who would jump up here and holler that these successful farmers are often after easier money and bigger and better sales, and they don't give a hoot about the benefits to bellies beyond. Knowing better myself after long years of working beside rural folks, I can testify that isn't so. If consumers had as many men of good will to deal with in other lines as they have in agriculture, they'd be calling this country—Utopia.

But the same thing holds true for some industrial workers who never see the ultimate users of their goods. Many patient men at lathes, shoe benches, and in suit-making shops and steel plants put their best experience and good sense and skill into each nail, each stitch, and each rivet—so that happiness, satisfaction, and safety will be a reality to someone somewhere who has put trust in what they deliver.

WHEN you are sailing out in the restless, angry ocean and you peer out the portholes at huge waves reaching toward you with wild gestures of power, then you rely upon the faith you have in the training of the crew and beyond and behind that, in the ability and the integrity of the ship builder who raised her hull and the dock inspectors who grant her a licensed passage because she is seaworthy and sound.

In countless occupations and professions there are men and women who take pride in doing the best they know how, over and above the "call of duty," as the war medals specify. And we might add, over and above and beyond any monetary remuneration which they are so fortunate or unfortunate as to receive from their boss or from the corporation, or even from the State or the Federal treasury.

So often we hear folks say that it's no wonder a certain specialist of some kind has made a success, because, they add, he has always been well paid and has never had to worry about financial reverses. Or else they try to disparage a donation or a good-will idea made by some tycoon of commerce, on the grounds that it all comes out of his net income tax statement, and it represents free advertising besides.

I always take such comment with a whole bucketful of salt. That disinfects the situation. For it stands to reason that good will is something that ought to get fair play in the public eye and not be forever subjected to irony and criticism. There is hardly anything in the record as far as I have seen which prevents a man who earns a fortune from being gentle and discerning and generous and just as full of honest good will as somebody else

who only has a tiny mite of the "dollar exchange" we hear so much about these days.

In the final analysis, the only way to express good will in an effective and tangible form is to take just what ability and talent you have and use it for that purpose. It may be physical strength, endurance, and muscular power; or lots of spare cash; or wisdom in some useful line; or experience which serves as a guide to somebody; or such plain arts as cooking, sewing, knitting, or tinkering with tools; yes, and even writing or public speaking. The idea is to give all you've got when a crisis hits somebody.

You can't rely upon stores or warehouses or banks to supply you with evidences of good will that you can hand around by proxy or send by mail —that is, you can't do it that way and so escape putting some personal feeling and action into good will. I've known fellows with overflowing energy and good will who accomplished more by direct activity and individual push and friendly help in community improvement than some club or church or civic body could do by distributing circulars or holding benefit parties.

ANOTHER funny thing about good will is that before you try to pop off with a sample of it you must be sure that the time is ripe and the need for it really exists. Trying to manufacture sentiment or reform or benevolence is like setting up a straw dummy and putting a match to it. It makes a whopping big blaze, but the warmth soon dies out and nobody but the dummy has been changed. Misdirected and ill-timed good will is almost as bad in its way as having none at all. In some ways it's worse, because other folks may hold back afterwards when they feel a good-will spell coming on.

This bring to mind the modern community chest or federated welfare project, which is now a common method of combining the essential good-will agencies into one unit for the purpose of financial contributions. We can all see the reason why the present united and single solicitation is better and more effective than the old, scattered method.

I regret that we often miss the quotas which the organizations set up, but before this time we missed our quotas a heap wider and left plenty of worthy agencies out in the cold. Sometimes there creeps into these campaigns a rather deadly sameness and dullness, such as we all have when we are obliged to do our duty without much inside enthusiasm. Often we have had some bad adjustments and unfair allotments to contend with, which cut the returns; and we always have the hardest time to cash in when we hold these drives

(*Turn to page* 50)

Fig. 1. Row of tomatoes, left, did not receive starter solution. Right, this row got starter solution. Note difference in growth.

Fertilizing Vegetable Crops

By J. H. Boyd[1] and J. O. Dutt[2]

VEGETABLE growers today are again facing the old prewar problems of yields per acre, cost per unit of production, and crop management efficiency. Although we forgot these problems to some extent during wartime, their return now is as inevitable as the tide. As vegetable growing is one of the first phases of agriculture to feel the effect of lower consumer prices, efficient growers are developing the inquiring mind toward their fertilizer practices.

Commercial fertilizers, of course, play a vital part in any soil-management program regardless of the crop. Let it be said at the outset, however, that large quantities of fertilizer do not of themselves guarantee high yields. Furthermore, there is no one best fertilizer for any one vegetable on all soils or for all vegetables on any one soil.

Commercial fertilizers effectively increase vegetable yields when: (1) Enough lime has been applied to grow good red clover or to give a soil reaction of pH 6.0 to 6.6; (2) the soil's organic matter content is comparatively high; (3) there is no serious lack of a minor element or elements; (4) there is good soil drainage; (5) there is a balanced supply of soil mois-

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[2] J. O. Dutt is Professor of Vegetable Gardening Extension, Pennsylvania State College.

ture; (6) erosion or leaching is not serious; and, (7) the fertilizers are applied properly. Perhaps other conditions should be considered, but those named here require the grower's most frequent attention.

Lime—Organic Matter—Minor Elements

Liming for vegetable crops—It is generally true that vegetable crops grow best on soils which contain only small amounts of acid or sourness. Most vegetables require at least moderate amounts of lime in the soil to neutralize acid conditions and to supply adequate amounts of available calcium for direct nutritional purposes. Usually a soil which will grow good red clover will be suitable for vegetable production. In terms of the pH value, a standard measurement of soil acidity, this means a pH level of about 6.5.

However, vegetables vary considerably in the amounts of acid which they will tolerate. Table I gives an approximate pH range within which the various crops will grow satisfactorily when other factors are favorable.

This table must be regarded as being very general. Many other factors, such as soil texture, organic matter, colloidal content, moisture content, and drainage affect the response of plants to soil acidity or lime applications. It is not possible to give the best soil reaction for any particular vegetable crop under all conditions.

Remember also that the lime content of the soil greatly influences the availability of the fertilizing materials which are applied. Lime should be applied to soils, where needed, several months ahead of planting time or to some previous crop in the rotation, preferably a small grain or sod crop. This is especially true where lime will be badly needed to correct soil acidity before spring plantings. A good practice is an application to a cover crop the preceding fall.

Regardless of how lime is applied, it must be worked thoroughly into the soil. Nutritional deficiencies sometimes will occur in vegetable seedlings when lime is applied on the surface and not worked into the soil. The kind of lime applied has no particular influence on the final effect. Both ground limestone and hydrated lime are equally effective in reducing soil acidity when applied in equivalent amounts. About 1,500 pounds of hydrated lime are equivalent to 2,000 pounds of ground limestone. Hydrated lime acts more quickly, but ground limestone has a more lasting effect and is cheaper.

TABLE I—pH RANGE OF VARIOUS VEGETABLE CROPS

Crops which will stand a slight amount of acid pH 6.0–6.7	Crops which will stand a moderate amount of acid pH 5.5–6.7	Crops which will stand a strong amount of acid pH 5.2–6.7	Crops which will stand a very strong amount of acid pH 4.8–6.7
Asparagus	Broccoli	Brussel Sprouts	Watermelon
Beets	Cabbage	Carrots	
Celery	Cauliflower	Endive	
Lettuce	Cucumber	Kale	
Onion	Eggplant	Parsley	
Spinach	Lima Beans	Pumpkin	
	Muskmelon	Rutabaga	
	Parsnip	Snap Beans	
	Peas	Sweet Corn	
	Peppers	Sweet Potatoes	
	Radish	Tomatoes	
	Squash	Turnips	

It takes relatively less lime to raise the pH of a sandy soil one full point on the pH scale and more on a heavy soil well supplied with organic matter. However, a ton of finely pulverized limestone will raise the pH about 0.5 of a point. Once a soil is sweetened, a ton of ground limestone every four years usually keeps it sweet. Larger amounts would only store up excess calcium in the soil. On soils which are likely to be deficient in magnesium, the use of dolomitic ground limestone is desirable.

Soil organic matter—Every effort should be made to grow legume and non-legume crops in the rotation. They will aid in supplying nitrogen and organic matter to the soil.

Organic matter gives the soil a good structure and improves its tilth. It keeps the mineral elements more available to the plants and serves as a storehouse for nitrogen, available phosphorus, potash, and other elements. Organic matter also provides food for beneficial soil bacteria.

Rotations including grass-clover sods add organic matter to the soil. Domestic ryegrass, seeded 20 to 30 pounds per acre just after the last cultivation in late July or September, develops an extensive root system, which is very important in conditioning the soil and building up the organic content.

Fall cover crops, such as rye or ryegrass, following vegetable crops will utilize the excess nutrients, especially the nitrogen, that would otherwise leach away in many cases before the next growing season. A good growth of rye or ryegrass also will help much to reduce water and wind erosion.

Soils containing very little organic matter (less than 1 per cent) should be planted to soil-building green manure crops or to sod for one or more seasons before planting vegetables. For quicker results, it may be well to apply 300 to 500 pounds of complete fertilizer, such as 5-10-5, 5-10-10, or 4-12-8, to each acre before seeding the green manure or sod crop.

All kinds of farm manures make excellent fertilizer materials. Whenever a grower uses any one of them he will need less commercial fertilizer. However, all manures are proportionally low in phosphorus and this element needs to be added as 20 per cent superphosphate.

TABLE II—COMPOSITION OF MANURES AND ADDITIONS REQUIRED FOR BALANCED FERTILIZER

10 tons of manure	Contains approximately Pounds			When supplemented with		Is approximately equal to	
Kind	Nit.	Phos.	Pot.	Lbs.	Materials	Lbs.	Kind of fert.
Horse and straw.....	110	55	132	750	20% superphosphate	2,000	5–10– 5
Steer and straw.....	110	70	96	600	20% superphosphate	2,000	5–10– 5
Dairy cow and straw.	90	60	84	1,000	20% superphosphate	2,000	4–12– 4
Hog.....	130	127	96	550	20% superphosphate	2,000	6–12– 6
				50	50% muriate of potash		
*Sheep and straw....	200	90	168	1,000	20% superphosphate	2,000	10–10–10
				65	50% muriate of potash		
*Poultry.....	180	175	96	160	50% muriate of potash	1,800	10–10–10

* Under most conditions it is not a good practice to apply more than four tons of poultry or sheep manure per acre if it is broadcast or plowed under. When used as a topdressing these two kinds of manure should be used sparingly at the rate of about one to two tons per acre.

Fig. 2. Proper fertilization had much to do with this 20-ton-per-acre yield of cabbage.

In order to make a balanced fertilizer out of sheep, poultry, and hog manures it will also be necessary to add muriate of potash. Suggested approximate additions are listed in Table II.

In addition to the three major elements, nitrogen, phosphorus, and potash, manure also contains many of the important minor elements which are essential to plant growth. It is also an excellent source of high-grade organic matter which improves soil conditions and greatly influences the availability of all plant-food materials. These are some of the reasons why manure is such an essential factor in soil management for vegetable crop production.

Minor elements—Deficiencies of boron, magnesium, and manganese have been found in certain areas of the State. These deficiencies may occur on: (1) Highly acid soils; (2) overlimed soils; (3) badly leached soils, and (4) soils receiving large amounts of chemical fertilizer without the addition of sufficient organic matter. Any grower who suspects a minor-element deficiency should consult the County Agricultural Agent for details as to treatment. Certain minor elements, especially boron, may do great harm to crops if too much is applied. The various vegetable crops are quite different in their minor-element needs.

Methods of Applying Fertilizer

Methods of using fertilizer are numerous and varied. The successful vegetable grower must be able to select the method best suited to his soil, rotation, the immediate crop to be grown, and his available equipment.

Broadcast drilling is perhaps the most common method of application. An ordinary grain drill with fertilizer attachments is used to place the fertilizer as deeply as possible after most of the seedbed preparation has been done. The object is to get the fertilizer down at least three to four inches deep without actually mixing it with the soil. This method is best adapted to early, shallow-rooted crops grown either in narrow or drilled rows, such as peas, radishes, leaf lettuce, beets, turnips, etc. Rates of application range from 500 to 1,000 pounds, depending on the crop and the specific situation.

Plowing down of fertilizer is becoming more popular on the heavier clay loam soils. Greater availability during midseason and particularly during dry seasons has led to its general adoption. There are two principal ways of using this method. In the first, the fertilizer is distributed evenly on the surface before plowing and then turned under. In the second case, the fertilizer is placed in a narrow band at the bottom of the furrow behind the plow and is covered by the next furrow without mixing it with the soil in any way. This method has given good results with many of the deeper-rooted crops, such as tomatoes, sweet corn, beans, cabbage, and even carrots and peas. Amounts per acre range up to 1,500 pounds when this is the only method used.

Band application of fertilizer on each side of the row about two inches away from the seed or plant and three to four inches deep is a desirable method where a relatively small quantity of fertilizer is used. This method is used more often for supplementary applications in combination with drilling, broadcasting, or plowing down. In some cases, broken bands are used to place short strips of fertilizer near the plant where the spacing in the row is wide. Amounts are usually 300 to 800 pounds per acre.

Sidedressing is practiced by placing the fertilizer in bands on each side of a row of plants after growth is well started. The bands often are four to eight inches away from the plant. Complete fertilizers are commonly used and are applied by the use of attachments on cultivators. The amounts commonly applied are 200 to 300 pounds per acre. Applications of this type may be particularly effective on light sandy soils.

Topdressings of readily available nitrogen (mineral), such as nitrate of soda or sulfate of ammonia, promote leafy growth, especially on sandy soils and such crops as leaf lettuce, spinach, early cabbage, and broccoli. They are placed on the soil surface and cultivated in at the rate of 100 to 200 pounds per acre. Applications of this nature are sometimes needed after heavy rains.

Starter solutions—Early growth is hastened and plants become estab-

(*Turn to page* 40)

Fig. 3. Plowing under fertilizer with a cover crop is a good practice.

Fig. 1. Sericea on farm of Freddie Brown, a cooperator with the Gaines Creek SCS District, McAlester, Oklahoma. Sericea cut at this stage makes good hay.

Grow Lespedeza Sericea For Forage and Soil Improvement

By W. M. Nixon and E. H. Greene

Soil Conservation Service, Fort Worth, Texas

LESPEDEZA sericea, a good soil-conserving, soil-improving hay and pasture plant, is fast taking its place in the coordinated soil conservation program of farmers in eastern Oklahoma, Arkansas, eastern Texas, and Louisiana.

Not too many years ago most agricultural workers as well as farmers were doubtful concerning its value. Soil Conservation Service technicians, looking for a perennial leguminous hay and grazing plant which would fit well into a soil-conserving and soil-improvement program, observed that there were a few farmers who were growing this crop and using it primarily for hay. Being a perennial, deep-rooted legume, there was no question but that it should be tried in the program. Technicians began to encourage soil conservation district cooperators to make plantings of sericea. It was found that sericea would grow well on soils where alfalfa or other desirable perennial legumes would not grow.

Sericea is well adapted to both heavy and sandy soils. It will not thrive on marshy land or where the water table is near the surface. Sericea does best on well-drained soils; however, it will

grow on wetter, heavier soils than kudzu.

Soil Conservation Service technicians, through their assistance to district cooperators in establishing sericea, have found that the following cultural methods are essential to successful establishment:

1. Prepare firm, clean, smooth seedbed.
   a. Flatbreak or disc the site at least one month ahead of seeding.
   b. Allow seedbed to be firmed by rain if possible.
   c. If bermuda grass is present where sericea is to be planted, the area should be flatbroken to a very shallow depth during the dry summer months. This can usually be done in the latter part of July or August. It is very important that as much of the bermuda grass as possible be eliminated, since a heavy sod will crowd out sericea.
2. Apply broadcast 300-600 pounds of 0-12-12 or 3-12-12 when land is being prepared or disc in immediately prior to seeding. Firm seedbed by rolling with a cultipacker or corrugated roller. If these are not available, firm the soil with any available roller or drag.
3. Inoculate seed.
   a. Use inoculant for cowpea group.
   b. Put seed in a container, moisten slightly, and thoroughly mix inoculant with seed.
   c. Keep sunlight from seed to prevent killing of bacteria.
4. Plant at right time.
   a. Southern Arkansas and southeastern Oklahoma, Louisiana, and east Texas—latter part of February and March.
      Northern Arkansas and northeastern Oklahoma—April and May.
      (The above months are optimum planting time. Successful stands have been obtained when seeded in June, but moisture conditions were ideal.)
   b. Broadcast seed evenly, using 30-35 pounds of scarified seed per

Fig. 2. District cooperators working together in conservation group baling sericea hay. Hopkins-Rains-Wood SCS District, Northeast Texas.

acre. Where unscarified seed are planted, the seeding rate should be doubled and the seeding done approximately one month earlier. Successful stands have been established by fall planting of unscarified seed.

c. Run cultipacker or roller over area immediately after seeding.

5. Control weeds. Care should be taken to control weeds during first year. Raise the mower blade so as to clip the weeds off just above the top of sericea plants.
6. Do not graze sericea during first growing season.
7. If sericea shows a nitrate deficiency the first year, topdress with 100 pounds of ammonium nitrate or its equivalent per acre. Nitrate deficiency will usually show up when plants are 3-5 inches high.

The following results on runoff and soil losses from sericea lespedeza as compared with continuous cotton were obtained at the Southern Piedmont Conservation Experiment Station, Watkinsville, Georgia:

December 1943–November 1946

	Average % Runoff	Total 3-year Erosion loss
Lespedeza sericea..	7.8	.56
Continuous cotton.	24.0	84.84

In order to get a top quality hay, sericea must be cut when plants are 12-15 inches high. If allowed to become any taller, the hay will be coarse and stemmy and will retain only a small percentage of its leaves.

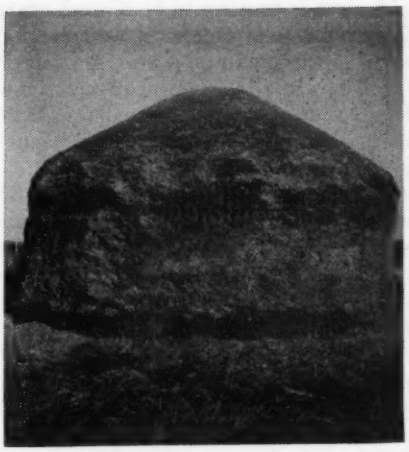

Fig. 3. Stock of ground sericea hay on C. E. Staner's farm near Wagoner, Oklahoma.

The number of cuttings depends on the season. An average of two cuttings a year may normally be expected. The last cutting should not be made later than August to allow the plants to have six inches or more growth before frost. Good stands have been killed out by cutting too late.

Hay yields from well-established sericea will average 1-2 tons per acre each cutting, Table I.

Sericea hay cures rapidly and should not be left too long before raking and baling. Sericea cut in the morning should be raked in the afternoon and baled the next morning. If it is not to be baled, it can be hauled in and stored as it is raked.

TABLE I.—YIELD OF SERICEA HAY AND ITS RELATIVE VALUE AS COMPARED WITH A FEW OTHER HAY CROPS.

Type of Hay	Yield Tons	Protein %	Calcium %	Phosphorus %
Lespedeza, annual	1–2	9.2	0.99	.19
Lespedeza, sericea	1–3	10.7	1.01	.24
Alfalfa	2–4	10.6	1.43	.21
Bermuda grass	1–2	3.7	0.48	.20
Kudzu	1–3	12.0	1.50	.27

(Taken from Morrison, F. B., 1937—Feeds and Feeding)

Sericea is proving to be a good grazing crop. It is especially valuable for early spring grazing. Cattle graze sericea best while the plants are succulent. If grazing is desired, the first growth in the spring can be used for this purpose instead of cutting for hay.

Where croplands are bordered by woods, the shading and the sapping of soil moisture by the trees often create a bare area. This is especially noticeable when the land is planted to cotton or corn. On sloping land and where farm implements are turned at field edges, gullies commonly form. Lespedeza sericea is one of the most useful plants for the protection of field borders. It not only protects the soil, but also provides a safe turnrow area. Many farmers harvest hay from sericea border plantings or use the borders for seed production blocks.

Sericea borders are often used by quail. These game birds nest and find shelter in the dense growing sericea. Although the seeds are little used by quail for food except when other foods are scarce, there are numerous records of quail feeding upon sericea. Bicolor lespedeza, a tall shrub which provides first-class quail food, is frequently planted with sericea. A few rows of bicolor next to the woods and a planting of sericea on the crop side form an ideal border planting. Such borders by providing soil protection, food and cover for wildlife, and hay or seed plots make good use of land that otherwise is often unproductive.

Sericea is an excellent soil-improving crop. Corn following a five-year-old stand of this legume yielded 53 bushels per acre, which was more than three times as much as the yield on similar land nearby where no sericea had grown. Its value as a soil-improving crop is shown by the following data obtained by the Tennessee Experiment Station on the yields of corn crops following sericea:

First crop	.....	72.1	bu.	per A
Second "	.....	66.5	"	" "
Third "	.....	60.2	"	" "
Fourth "	.....	51.7	"	" "
Fifth "	.....	46.9	"	" "
Sixth "	.....	41.9	"	" "
Seventh "	.....	36.6	"	" "
Eighth "	.....	35.4	"	" "
Ninth "	.....	29.5	"	" "
Tenth "	.....	33.6	"	" "

(*Turn to page* 39)

Fig. 4. A well-established border strip of sericea such as this serves many purposes in a soil conservation program.

Fig. 1. Contour cultivation, strip-cropping, and terracing retard the velocity of flowing water as it moves over the surface of the ground, but do not protect against raindrop impact, except in the sod strip itself.

Water Erosion Control on Cultivated Land

By J. H. Stallings

Principal Soil Conservationist, Soil Conservation Service, USDA, Washington, D. C.

SOIL erosion caused by rainfall is the result of the application of energy from two distinct sources. These sources are first, the falling raindrop and second, surface flow (7) [1]. The energy exerted by the falling raindrop is applied slantingly or vertically from above, while that of surface flow is applied more or less horizontally from the side. Both the falling raindrop and surface flow detach and transport soil material in the erosion process. The chief role of the falling raindrop, however, is to detach soil particles whereas, the primary role of surface flow, outside of rills and gullies, is to transport soil. This discussion deals primarily with erosion resulting from rain falling on the area affected directly and does not treat erosion caused by water which may enter the area from an outside source.

Although the primary role of the falling raindrop in the erosion process is detaching soil particles, it plays a secondary role which is often as equally important. The falling raindrop makes a major contribution to the movement of soil on unprotected sloping lands, during periods of heavy impact storms, by splashing large quantities down

[1] Refers to literature cited.

slope, and by imparting transporting capacity to surface water by keeping it turbid.

The falling raindrop blasts the soil particles apart at the point of impact, and surface flow tears the soil particles from their moorings by the scouring process. The maximum amount of damage is done during periods of heavy impact storms when the falling raindrop and surface flow team up on bare land.

Since the falling raindrop applies its energy from above, it requires remedial measures entirely different from surface flow which applies its energy horizontally across the surface of the ground. Measures aimed at controlling the effects of the falling raindrop, to be effective, must be designed to intercept and de-energize the raindrop before it strikes the ground. These measures aimed at controlling surface flow must be designed to regulate concentration and to retard the movement of free water as it flows over the ground.

When falling raindrops strike the ground surface, or the thin film of water covering it, they splash bits of soil and organic matter into the air. Some of those splashed particles may rise to a height of two feet or more and move horizontally more than five feet on the level surface (4). On sloping ground most of the splashed material moves down slope. Two inches of rain on an area exerts enough total energy to raise a 7-inch layer of soil a height of three feet over the area if the energy could be applied at one time (11). More than 100 tons of soil per acre may be splashed by the most beating types of rain falling on a bare highly detachable soil (6).

Photo by Naval Research Lab.

Fig. 2. Each falling raindrop acts as a miniature bomb. Upon striking the bare ground falling raindrops blast soil particles and organic matter into the air.

Control of erosion caused by the falling raindrop can be accomplished by the proper use of vegetal covers, either living or dead. Vegetal covers when properly used on the surface of the ground serve as a cushion to absorb the energy of the falling raindrop and destroy its power to splash soil (1). Soil not splashed or torn loose by the falling raindrop is not likely to undergo any serious erosion. Vegetal and mulch covers may reduce the soil losses by erosion to less than one per cent of those on similar but unprotected soils.

Control of Raindrop Splash

The first step in developing a program to control erosion by raindrop splash is (a) to determine the potential capacity of the rainfall to erode during each season of the year, (b) determine the vulnerability of the soil to this type of erosion, and (c) plan a cropping system that will provide adequate vegetal cover to furnish protection in sufficient amounts at the proper time. The potential capacity of the raindrop to erode can be determined in a general way by reviewing the local rainfall records which show intensities. These data when arranged in chart form showing rainfall intensities by months may be used for this purpose. The rainfall intensity data may also be expressed in terms of the number of exces-

sive storms by months. Rains falling at the rate of .25 inch during a 5-minute period or at the rate of .35 inch during a 15-minute period for all practical purposes may be considered excessive or severe erosion-producing rains. However, it is likely that more detailed information about the impact characteristics of raindrops will be needed as we move further into this method of studying erosion control.

In most localities the major portion of erosion is the result of a small number of rains. In some areas as much as 80 per cent of the annual erosion may be attributed to a half dozen or so intense storms. In practically all locations, more than half of the annual erosion may be attributed to a small portion of the total number of rains occurring during the year. By examining records of individual rainstorms for the locality it is possible to identify the season or seasons of the year when these erosion-producing storms occur.

Records from the Arnot Soil Conservation Service Experiment Station at Ithaca, New York, illustrate this point (9). Twenty-one rains or less than 12 per cent, out of a total of 177 which caused .5 ton or over of soil loss per acre each, accounted for 65 per cent of the total soil loss during a period of eight years and seven months ending December 31, 1943. Two of these rains caused 17.7 per cent of the soil loss.

A breakdown of the 177 rains at the Arnot station into intensity groups illustrates the importance of the rainfall intensity in the erosion process, Table I. These rains have been broken down into eight different groups, based on the maximum intensity for a 15-minute period, and the amount of soil lost by erosion from each group is presented.

The character of the rainfall is more important than the total amount of rain falling in causing erosion, when other conditions remain constant (3). A slow gentle rain is not nearly so destructive as an equal or even smaller amount of rain falling in only a small fraction of the time.

Fifty-five of the rains had an average total rainfall of .54 inch and an average maximum intensity of .5 inch for a 15-minute period. The average soil loss by erosion for the rains in this

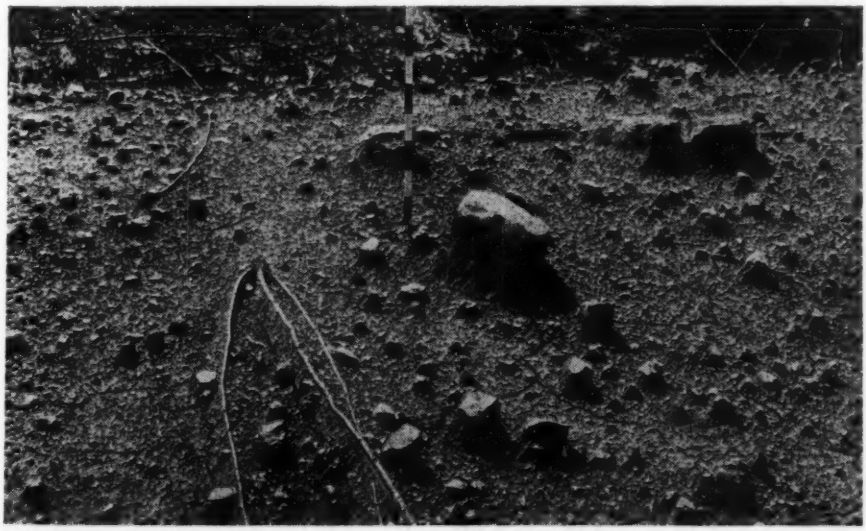

Fig. 3. About two inches of soil were removed from this plowed field by water erosion. The stone-capped pedestals show that the force causing the erosion was applied from above and not from the side as surface flow. The dead plant roots in the foreground protected the soil immediately beneath them while that between and to the side of them was splashed away.

group was eight pounds per acre. The next group, consisting of 29 rains, had an average total rainfall of .59 inch and a maximum intensity of .63 inch for a 15-minute period and eroded 57 pounds of soil per acre. The total rainfall in this group increased only .05 inch over the first group and the maximum intensity increased .12 inch over the 15-minute period, while the soil loss increased from eight to 57 pounds per acre. An increase in the intensity from 1.5 to 2.16 inches per hour for a 15-minute period increased the soil loss by more than 121 per cent with only .18 inch increase in the total amount of rain that fell. A total rainfall of 1.35 inches falling at the maximum rate of four inches per hour for a 15-minute period removed 14,427 pounds of soil per acre whereas, a total rainfall of 1.73 inches falling at a maximum intensity of 2.73 inches per hour for a 15-minute period removed only 5,704 pounds of soil per acre.

Other rainfall data from the Arnot station show that the main erosion hazard from rainfall occurs during the period of June-September, inclusive. During this same eight years and seven months period, the average annual excessive rains were: eight during June; 11 during July; 14 during August; four during September and one during October. No excessive rains occurred during any of the other seven months.

TABLE I.—NUMBER OF RAINS CAUSING .5 TON OR OVER OF SOIL LOSS PER ACRE, AVERAGE RAINFALL, MAXIMUM RAINFALL INTENSITY FOR 15-MINUTE PERIODS, AND SOIL LOSS PER ACRE AT ITHACA.

Number of rains	Average rainfall	Average maximum rainfall intensity 15-minute period	Soil lost
	Inches	Inches per hour	Lbs. per acre
55	.54	.50	8
29	.59	.62	57
33	.68	.77	232
12	.77	1.14	721
27	.94	1.50	1,594
9	1.12	2.16	3,527
10	1.73	2.73	5,704
2	1.35	4.00	14,427

TABLE II.—AVERAGE ANNUAL RAINFALL, MAXIMUM 15-MINUTE INTENSITIES, AND EXCESSIVE STORMS BY MONTHS AT GUTHRIE, OKLAHOMA, 1930-1940.

Month	Rainfall	Maximum 15-minute intensities	Excessive storms [1]
	Inches	Inches	Number
January	1.45	.31	0
February	1.44	.87	.1
March	1.87	.93	.3
April	2.60	1.67	.9
May	4.37	2.45	1.6
June	3.73	2.08	1.6
July	1.63	1.72	.5
August	3.42	2.08	.9
September	3.67	2.13	1.1
October	1.97	1.15	.5
November	2.56	.60	.2
December	1.50	.33	0

[1] Average annual for 17-year period.

Total rainfall by months is not as reliable as rainfall intensity data or the number of excessive storms by months but may serve in the absence of the more reliable data in developing a rainfall hazard chart. This is illustrated by data obtained at Guthrie, Oklahoma, Table II, where the period of greatest total rainfall runs from April to November, inclusive (2). This coincides only roughly with the period of highest 15-minute maximum intensities, which extends from April-October, inclusive. The months of April, May, June, August, and September are the months having a large number of excessive storms (13).

The advantages of using the number of excessive rains per month over the use of the total rainfall, in establishing

the rainfall hazard chart, is illustrated by the data obtained at Tyler, Texas, during the period 1931-1940 (12). Soil loss from continuous cotton plots during this period was more closely related with the number of excessive storms than with the total rainfall. This is illustrated by the data in Table III, which shows the average annual total rainfall, the number of excessive storms, and the tons of soil lost during the 10-year period.

By examining the data in Table III, it may be seen that the three months November-January, inclusive, record the highest total rainfall, while the period April-August, inclusive, includes the largest number of excessive storms. The period April-July, inclusive, includes the months showing the greatest soil loss by erosion. During June and July the total rainfall was relatively small compared with that of November, December, and January, when the loss was considerably lower than during the April-July period. It should be noted, however, that there was both a substantial rainfall hazard and soil loss during each month of the year at Tyler.

The occurence of excessive storms is not necesarily the same from month to month in different areas. This is shown by the data in Table IV, which shows the number of excessive storms by months for varying periods of time at five different locations (13). For the most part the period May-September, inclusive, represents the months of the greatest rainfall hazard for these particular localities.

TABLE III.—AVERAGE ANNUAL RAINFALL, NUMBER OF EXCESSIVE STORMS, AND SOIL LOSS BY EROSION ON CONTINUOUS COTTON LAND AT TYLER, TEXAS, 1931-1940.

Month	Rainfall	Excessive storms	Soil loss
	Inches	Number	Tons per acre
January	4.17	.5	.52
February	3.92	.4	.22
March	3.55	.8	.60
April	3.95	1.5	1.85
May	3.40	1.2	4.61
June	2.67	1.6	1.99
July	2.87	1.5	1.45
August	2.34	1.5	.54
September	2.04	1.0	.35
October	2.82	.4	.49
November	4.11	.8	.76
December	5.45	1.0	.97

TABLE IV.—AVERAGE ANNUAL NUMBER OF EXCESSIVE STORMS BY MONTHS FOR VARYING PERIODS AT FIVE DIFFERENT LOCATIONS.

	Bethany,[1] Mo.	Clarinda,[2] Iowa	Hays,[3] Kans.	La Crosse,[4] Wis.	Statesville,[5] N. C.
January	0	0	0	0	.3
February	0	0	0	0	0
March	.1	0	.1	.1	.8
April	.1	.8	.1	.5	.3
May	1.4	1.1	.8	.7	.7
June	1.8	2.1	1.4	1.3	1.7
July	1.0	2.0	.6	1.5	2.0
August	1.3	1.0	1.1	1.2	3.0
September	.9	.8	1.0	1.1	.3
October	.4	.5	0	.3	.8
November	.1	0	.1	.1	.5
December	0	.1	0	0	0

[1] Average annual for 10 years.
[2] Average annual for 8 years.
[3] Average annual for 9 years.
[4] Average annual for 15 years.
[5] Average annual for 6 years.

We have seen that rain storms vary widely in their capacity to erode soil. We find, likewise, that soils differ greatly in their stability or their capacity to withstand the erosive forces set into motion by falling raindrops. Soils deficient in those properties which impart stability are more vulnerable to the raindrop impact than those which are high in such properties. Soils having low resistance to the raindrop impact usually require more intensive protective measures than those possessing high resistance.

The difference between the forces supplied by the falling raindrops and the resistance offered to those forces by the soil represents the energy remaining to be absorbed by vegetal covers if erosion is to be controlled successfully. As is to be expected, vegetal covers vary widely in their protective values against falling raindrops. The kind, amount, and uniformity of distribution of vegetal cover influence its effectiveness. Dense, low-lying covers are more effective than coarser covers resting either on or some distance above the surface of the ground. Other things being equal, the protective value of vegetal cover, in controlling raindrop splash, varies more or less directly with the amount of cover. Even small amounts of vegetal cover exert a worthwhile influence.

Tests conducted on shallow, mixed range soils (5), to determine the effect of vegetal cover on reducing soil-splash by the falling raindrop, show that 657 pounds of range-forage cover per acre reduced the amount by 73 per cent of what it was on bare soil. The same tests show that 1,292 pounds of range-forage cover reduced the amount by 93 per cent, 1,865 pounds of cover reduced it by 96 per cent, and 5,592 pounds of cover reduced it by over 99 per cent. Corresponding figures obtained from similar tests conducted on hardlands (Pullman soil) show a reduction of 52 per cent of soil splashed by falling raindrops for 704 pounds of range-cover per acre, 90 per cent for 2,016 pounds of cover, 96 per cent for 3,307 pounds, and over 99.5 per cent for 4,785 pounds of cover per acre.

Vegetal covers are also effective in re-

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Fig. 4. Surface flow does its greatest damage when water accumulates to form channels. The major part of erosion occurring outside of rills and gullies is caused by raindrop splash. If the surface of the ground is kept protected with suitable vegetal cover, little erosion will occur on the areas between the rills and gullies.

Fig. 1. Land must be cleared in preparation for a strawberry field.

The Pacific Northwest Knows How to Grow Strawberries

By Louis King

Horticultural Inspector, Washington State Department of Agriculture

THE strawberry business in the Pacific Northwest has many growers who started with no capital and are now well established on their own fine farms. For instance, a grower and his wife who came to Western Washington from Missouri about 10 years ago, with only their hands to work with, have acquired one of the finest farm homes one could wish for, built at an estimated cost of $40,000. The land, home, and all equipment were paid for by the Marshall strawberry.

The coastal area is famous for the strawberries grown there and frozen for shipment throughout the United States. The land lies between the snow-clad Cascade Range on the east and the Pacific Ocean on the west. The climate, tempered by the Japanese current, is one of cool summers and mild winters.

History of Strawberry Industry

About 1904, Chap Bayes, a farmer in the Lynden, Washington, district, decided to test on his farm all of the available varieties of strawberries. He planted more than 100 and brought

them into fruit. The Marshall variety was by far the best producer of fine-flavored fruit and was selected by him to be grown commercially. Planting stock was increased and soon became the most popular in the West. His son, Marshall Bayes, is growing the Marshall strawberry now.

In 1913, much of the land still covered with timber, as well as the cut-over land, was being settled. O. L. Sheets, who came from Missouri to work in a shingle mill, bought 40 acres of stump land near the mill where he was working. He and his wife built a small house, cleared one acre of ground, and planted Marshall strawberries. These grew so well that he cleared more land and planted more strawberries. The berries in those days were all sold as fresh fruit, and production was limited to the acreage a man and his family could pick and deliver to the towns.

Acreage Expansion

Most of the growers used horses and had to go from 10 to 15 miles to make their sales. About 1915 some of the growers were able to buy Model T's, and could get to town a little earlier or even make two deliveries a day. During the first world war canneries using strawberries for canning and jam were starting. This had the effect of expanding acreage.

The advent of freezing strawberries in barrels was the signal for a further increase in acreage. Growers could now be assured a market for the fruit from larger acreages. In 1929, the first signs of depression caused the packing plants to close or be refinanced. Some processing plants were able to come back; others were sold and opened by the new owners. The price of strawberries went to the bottom.

Many growers were not able to carry on, since strawberries sold for as low as four cents a pound. However, through the depression the acreage kept expanding despite low prices, since strawberries would at least sell readily at some price and the growers could make a little by carefully watching their costs. As prices came up slowly, more growers started in the business. Companies were in competition for Northwest strawberries, with the highest prices coming after World War II, when they rose to 30 cents a pound. In 1948 the price was from 15 to 20 cents a pound, and acreage in Washington had expanded to 7,000 acres, nearly all being found in Western Washington.

State Department of Agriculture

In 1928, E. D. Hunter, District Horticultural Inspector at Everett, conceived the idea of certifying strawberry plants. There had never been any certified plants, so it was necessary to start with the best stock available. Nothing was known about diseases of strawberries, therefore when a new field was set out, it was carefully inspected for any off-variety or weak plants, which were removed and destroyed. There was nothing very scientific about this procedure, but it worked. It had the effect of producing a more uniform plant and fruit.

O. L. Sheets of Lynden, Washington, was one of the original growers of certified plants. He selected young plants from good vigorous parent stock. These were set out, kept free from runners for one year, and allowed to fruit the next year. Only vigorous plants with a good crop of well-shaped berries were allowed to produce runners that fall. Most of the Marshall strawberries growing in Washington have come from this foundation plot.

The State Department of Agriculture inspects strawberry plants for certification during the growing season and requires that weak and diseased plants be rogued as soon as they can be detected. It has become increasingly more difficult to keep the diseases and insects in check. Formerly it was necessary to take out only a few plants, whereas now it requires more roguing, dusting, and spraying to achieve the same results.

Plant pathologists, entomologists,

plant breeders, and agronomists, in the Experiment Stations of Washington and Oregon are devoting much of their time to the strawberry industry. The Washington State Department of Agriculture is cooperating in this work, having allotted $12,500 of their funds from the Insect Pest and Disease Control Fund to the Experiment Stations. Out of this work have come recommendations for the control of insects and diseases, as well as recommendations for soil management and fertilizer use. Several new varieties have been developed for trial. These are placed in the hands of growers in various sections throughout the State. Not until a new variety has proven itself, will it be released for commercial planting. Each grower receiving a few of these plants must sign a contract that he will not sell or give away any plants until the Experiment Station and packers have found the variety desirable.

The ideal variety would be one that is resistant to insect pests and diseases, would grow a large crop of fine-flavored, highly colored fruit, would not be subject to break-down under wet weather conditions, and would be firm enough to withstand stemming and slicing. In addition, the berries should be easy to detach from the plant and should stem easily. This is quite an order for the plant breeders, but Western Washington Experiment Station horticulturists are trying to produce such a plant for the Northwest strawberry growers.

Fig. 2. Not all fields are planted by machine. About an acre (3,500 plants) can be set by hand in a day.

Fig. 3. First-year strawberry plants are being fertilized by hand in the above photograph.

Commercial fertilizers have played a great part in the production of strawberries in this area. It is a general practice to use 700 to 1,500 pounds of 3-10-10 or similar mixture per acre. This is usually applied in two applications, one-half in the spring, the other in the summer after harvest. The use of fertilizers has increased the production on the average of 50 per cent. In 1930 when little fertilizer was used the average production was from 1½ to two tons per acre, while in 1940, with fertilizer a general practice, the average was three tons. In recent years some fields have gone as high as seven tons. At a price of 20 cents per pound for the berries, the additional increase in receipts makes fertilizer a good investment.

Extensive fertilizer trials on strawberries are now being conducted by the soils department of the Western Washington Experiment Station. Studies on fertilizer rates, ratios, placement, phosphate carriers, minor elements, and time of fertilizer application are underway. Applications of phosphate fertilizer at time of planting, followed later by broadcast or sidedress applications of nitrogen and potash, appear to be of particular interest and will be discussed in a station bulletin in the near future. As previously mentioned, these investigations are financed in part by special funds allocated to the Experiment Station by the Washington State Department of Agriculture.

Harvesting Methods

The harvesting of the berry crop in Washington requires a large importation of labor, from 7 to 10 pickers per acre being needed to pick the crop. In addition to the pickers, there are field bosses, field checkers, and truckers working to move the fruit to the processing plants. More than 50,000 people are required in the fields to harvest the strawberries in Western Washington.

All available labor is recruited in local communities. An advertising campaign is put on to bring pickers from all of the larger cities and even other states. Many of the larger growers establish their own labor camps. Some camps have centrally located hot shower baths and laundry facilities. One large grower has over $20,000 invested in one camp alone. The grow-

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Fig. 4. Hand picking results in high labor costs in the strawberry fields.

Fig. 1. Raleigh Experiment Field, 1920. J. E. Whitehurch standing in cornfield with treated land, LPK, on left and untreated land on right. Corn yields for 1920 and 1948 along with protein content for 1948 are:

	LPK	*None*
1920	60 bu.	24 bu.
1948	74 bu.	26 bu.
Protein	10.4%	8.6%

Observations of a Fieldman on Value of Experiment Fields

By C. J. Badger

Agronomy Department, University of Illinois, Urbana, Illinois

ILLINOIS Soil Experiment Fields were designed and put into operation largely through the efforts of the late Dr. Cyril G. Hopkins. These fields have been a strong influence in educating Illinois farmers in the rudiments of soil improvement. Such improvement has consequently resulted in an enlargement of our food supply. The wide distribution of these fields has given farmers almost a doorstep view of soil-building practices under local soil and climatic conditions.

When I went to work in the southern part of the State as a fieldman in 1920, I at once realized that I was somewhat of a glorified farm hand. My duties developed calluses on my hands, and I was usually glad when a rainy day came along—even though rain added to the hazard of driving the Model T over the many miles of dirt roads. I have always appreciated the rather broad experience and many other privileges the job afforded. From the start I was aware that folks showed me special deference because of the institution with which I was connected.

Evidently the hard-working men who pioneered before me had built substantially into the good will of the farmers and business men in southern Illinois.

As my first season progressed, I became amazed at the difference in crop growth on the treated and untreated plots of the fields upon which I worked. When traveling through the country I would see crops on the many farms which appeared similar to those on the experiment field plots. These crops were withered by drouth, discolored by starvation, and riddled by insects. I mentioned this discrepancy to my immediate superior, the late J. E. Whitchurch. He merely shook his head and said that even though progress was slow, many farmers were taking hold of the idea of soil improvement. He admonished me not to become too discouraged since in his experience, which had already covered 10 years, he had witnessed considerable progress.

J. E. Whitchurch previous to 1920 had built to his memory a monument of agricultural limestone. The Ewing experiment field is located about five miles from Whittington, the nearest shipping point. Each winter and spring all the vacant lots in and around the town were filled with mounds of finely ground limestone. This was brought about through the tireless efforts of Mr. Whitchurch, or "Uncle Whit" as we called him. When he was not engaged in overseeing field work, he was on the farmer's doorstep encouraging him to use limestone on his land. When the farmer became sufficiently interested, the order would usually be given to "Uncle Whit." He would see that the lime was delivered to the farmer's shipping point in due time. Many of these orders were filled in the winter and early spring when roads in those days would not permit heavy hauling. Each farmer would unload his car and pile the limestone on whatever space was available in Whittington. At times it became difficult to drive through the village because of the encroachment of these limestone mounds.

Farmers near these experiment fields who first followed "Uncle Whit's" friendly suggestions are now among the most prosperous in their respective communities. One of these farmers, in particular, has one of the finest sets of farm buildings in southern Illinois. In fact, he won a prize for having the most conveniently arranged and best kept farmstead in this area. This prize was awarded, also, on the basis that the results were accomplished entirely by returns from the farm.

Our local fieldman in 1920 at Ewing, the late J. R. Midyett, became an ardent follower of the limestone, legume, phosphate, potash program. Mr. Midyett was a dairy farmer and kept accurate accounts on his operations. When he presented his improvements in dollars and cents he left little room for further arguments along this line.

Mr. Midyett kept his farm in good condition both physically and financially. When he passed away, his daughter Lillian took over and ran the farm very successfully. This was such a good story that *Prairie Farmer* ran it along with Lillian's picture. The article created considerable interest and as a result Lillian was married to a young farmer in a distant county and gave up running the home farm.

The home farm is now operated by Knox Midyett, son of J. R. Midyett. Knox has kept up the soil treatment and rotation practices started by his father previous to 1920. His soybean, wheat, and clover yields are the talk of the neighborhood. In 1948 he baled a 40-acre field of red clover hay, and it was said that a man could walk over the entire field without stepping off a bale of clover.

Xavier Kiefer, who lived in an adjoining county, had heard about the Ewing experiment field and drove in one day to look it over. Both "Uncle Whit" and Mr. Midyett were there to explain things to him. He put up the very sincere argument that he was short of funds and didn't have the ready cash

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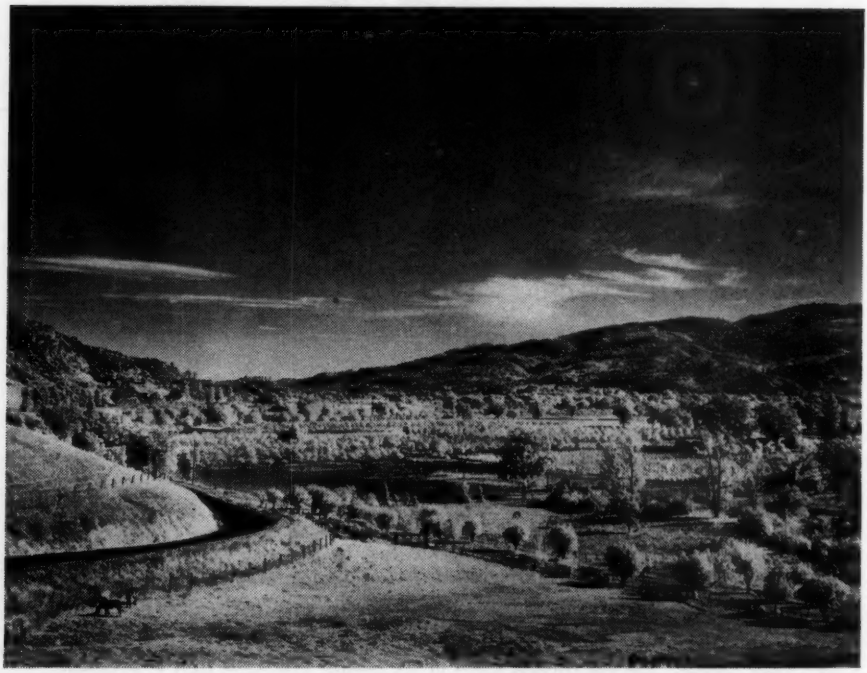
PICTORIAL

Miss Jeanne Burke of Providence, although a city girl, is a senior in agriculture at Rhode Island State College. She was crowned queen of the recently held Aggie Bawl at Kingston.

Courtesy WJZ Farm News Program

Above: **A Winter lane.**

Below: **Sunny California**



Above: **Doing nicely, thank you.**

Below: **Corn in snow-fence crib.**

Above: **An adult class in grain grading.**

Below: **Brain work takes fuel.**

The Editors Talk

Agriculture 1949

With 1949 drawing to a close, another near-record crop output and marketings of livestock are being written into American agricultural history. Despite the problems of surpluses which are looming over the horizon in some instances, what such abundance really means to the Nation is noted in some well-worded statements in the November issue of RURAL MARKETING, published by COUNTRY GENTLEMAN, Philadelphia, Pa. "Most of us would agree . . . man's first and most fundamental need is to satisfy his appetite for food. And we would probably admit further that there is a fairly close relationship between food and peace . . . between food and justice . . . between food and human happiness.

"We all immediately appreciate the importance of agricultural production of food. There are a few other facts about agriculture, however, that need to be repeated from time to time. How many persons, for example, know that industries which produce one-third of all our manufactured products would be completely crippled if they were deprived of agricultural raw materials? How many . . . realize that almost half of all the money American consumers spend for goods and services goes for products that originate on farms?"

On the other hand, what has 1949 meant to the farm operators? It is estimated that both prices received by farmers and cash receipts from farming will be about 10 per cent less than the record levels of 1948. This still will leave prices more than twice as high as before the war and incomes more than three times as high.

But there is more to figuring the progress in American agriculture than a summation in dollars and cents. There is to be recorded the advances in the science of farming, both in new research and in a fuller use of production technology already proved. To name a few, the amazing spread of farm mechanization to cut high labor costs has continued, and there has been research in the handling of farm products after they leave the farm. Strides have been made in the conditioning of crops for storage and for preserving their quality while in storage. Crop-drying units and means of insect and vermin prevention are coming into use. New and superior varieties of crops are being developed by plant breeders. Practical shifts in income-producing crops to effect wiser land use are being worked out. New food, feed, and industrial uses for field crops and their many by-products are being sought.

Dr. Robert M. Salter, Chief of the Bureau of Plant Industry, Soils, and Agricultural Engineering of the U. S. Department of Agriculture, reports tremendous gains resulting from soil management and fertilizer research. "Much has been learned about the significance of soil reaction and how to control it, about ways to conserve water in the soil for growing crops and to reduce erosion, about the use of crop rotations, legumes and green manures for replenishing soil humus and nitrogen, about procedures for determining the nutrient needs of crops,

and about materials, methods, and machines for meeting these needs efficiently. More and more is being learned about how to maintain soil structure—that is, the physical condition of the soil, its granulation and porosity.

"More extensive use is being made of fertilizers and manures in agriculture, and more efficient fertilizers are being developed," Dr. Salter says, pointing out the application of plant food in granular, liquid, and gaseous forms. It is his belief that if farmers in the United States had made full use of the new production technology already proved, they could have produced a corn crop the size of that of 1948, the largest ever grown, on one-third fewer acres, and at the same time had more income and improved their soil.

To shorten the time-lag between research and practical application, the United States and Canada have the finest agricultural extension forces in the world. To them must go a major share of the credit for the soundness of our fundamental industry. In their annual reports will be found the truest picture of Agriculture—1949.

Hunger Signs in Crops Up to Date

It is probable that the book, HUNGER SIGNS IN CROPS, published by the American Society of Agronomy and the National Fertilizer Association in 1941, needs little introduction to a large percentage of our readers. What may be news to them is the fact that a second edition, bringing the subject up to date with profuse illustration and easy-to-read text is just off the press.

The new book's foreword, written by Firman E. Bear, President of the American Society of Agronomy, and Russell Coleman, President of the National Fertilizer Association, best tells the interest in and demand for information with which to keep up with a plant's visual means of making known its nutrient requirements.

"When HUNGER SIGNS IN CROPS was first projected, those who cooperated in preparing the book believed they would be offering the agricultural public a much-needed treatise on the subject. Although rapid advances had been made by agricultural scientists in the study of nutrient-deficiency symptoms in crops, their work had not been assembled in convenient form.

"As in all such ventures, there was much uncertainty about the reception such a book would be accorded. Concern on this point was soon dispelled. Immediately after its announcement, orders began pouring in. Three printings were required, and high praise for the volume came from numerous organizations and individuals. The book was widely used by college professors, research and extension specialists, industrial chemists and agronomists, county agents, and teachers of vocational agriculture. Many farmers found it of much use in deciding on their fertilizer program.

"Rapid advances have been made in the knowledge of this subject, so that it has become necessary to prepare an entirely new edition. This second edition includes much material that has not previously been published. Many hours of unselfish labor have been devoted by the chapter authors to the revision. Credit is due also to their associates and colleagues who have offered suggestions and furnished photographs.

"Accordingly, the American Society of Agronomy and the National Fertilizer Association are now pleased to present to the public this second edition of HUNGER SIGNS IN CROPS. We hope it will continue to serve the cause of an ever better American agriculture."

Orders for the book should be addressed to the National Fertilizer Association, 616 Investment Building, Washington 5, D. C. The price is $4.50 per copy.

Season Average Prices Received by Farmers for Specified Commodities *

Crop Year	Cotton Cents per lb.	Tobacco Cents per lb.	Potatoes Cents per bu.	Sweet Potatoes Cents per bu.	Corn Cents per bu.	Wheat Cents per bu.	Hay[1] Dollars per ton	Cottonseed Dollars per ton	Truck Crops
	Aug.-July	.....	July-June	July-June	Oct.-Sept.	July-June	July-June	July-June	....
Av. Aug. 1909–July 1914	12.4	10.0	69.7	87.6	64.2	88.4	11.87	22.55	....
1924	22.9	19.0	68.6	149.6	106.3	124.7	12.66	33.25	....
1925	19.6	16.8	170.5	165.1	69.9	143.7	12.77	31.59	....
1926	12.5	17.9	131.4	117.4	74.5	121.7	13.24	22.04	....
1927	20.2	20.7	101.9	109.0	85.0	119.0	10.29	34.83	....
1928	18.0	20.0	53.2	118.0	84.0	99.8	11.22	34.17	....
1929	16.8	18.3	131.6	117.1	79.9	103.6	10.90	30.92	....
1930	9.5	12.8	91.2	108.1	59.8	67.1	11.06	22.04	....
1931	5.7	8.2	46.0	72.6	32.0	39.0	8.69	8.97	....
1932	6.5	10.5	38.0	54.2	31.9	38.2	6.20	10.33	....
1933	10.2	13.0	82.4	69.4	52.2	74.4	8.09	12.88	....
1934	12.4	21.3	44.6	79.8	81.5	84.8	13.20	33.00	....
1935	11.1	18.4	59.3	70.3	65.5	83.2	7.52	30.54	....
1936	12.4	23.6	114.2	92.9	104.4	102.5	11.20	33.36	....
1937	8.4	20.4	52.9	82.0	51.8	96.2	8.74	19.51	....
1938	8.6	19.6	55.7	73.0	48.6	56.2	6.78	21.79	....
1939	9.1	15.4	69.7	74.9	56.8	69.1	7.94	21.17	....
1940	9.9	16.0	54.1	85.5	61.8	68.2	7.58	21.73	....
1941	17.0	26.4	80.7	94.0	75.1	94.4	9.67	47.65	....
1942	19.0	36.9	117.0	119.0	91.7	110.0	10.80	45.61	....
1943	19.9	40.5	131.0	204.0	112.0	136.0	14.80	52.10	....
1944	20.7	42.0	149.0	192.0	109.0	141.0	16.40	52.70	....
1945	22.5	36.6	143.0	204.0	127.0	150.0	15.10	51.10	....
1946	32.6	38.2	122.0	218.0	156.0	191.0	16.70	71.90	....
1947	31.3	38.0	156.0	215.0	235.0	241.0	17.30	85.40	....
1948									
December	29.63	45.7	154.0	219.0	123.0	205.0	19.10	68.80	....
1949									
January	29.27	42.9	166.0	236.0	125.0	202.0	19.80	65.70	....
February	29.14	29.5	172.0	244.0	112.0	194.0	20.50	53.40	....
March	28.74	31.9	174.0	254.0	118.0	198.0	20.00	51.40	....
April	29.91	24.7	181.0	275.0	122.0	200.0	19.00	50.30	....
May	29.97	32.5	181.0	273.0	122.0	200.0	17.70	50.40	....
June	30.13	31.5	175.0	264.0	121.0	186.0	16.40	46.70	....
July	30.08	56.5	155.0	283.0	125.0	182.0	15.65	37.50	....
August	29.32	44.6	154.0	267.0	118.0	179.0	16.05	44.40	....
September	29.70	48.7	138.0	230.0	116.0	187.0	16.25	43.50	....
October	28.70	47.4	130.0	196.0	109.0	189.0	16.75	41.80	....
November	27.76	43.4	134.0	189.0	102.0	190.0	16.75	42.30	....
Index Numbers (Aug. 1909—July 1914 = 100)									
1924	185	190	98	170	166	141	107	147	143
1925	158	168	245	188	109	163	108	140	143
1926	101	179	189	134	116	138	112	98	139
1927	163	207	146	124	132	135	87	154	127
1928	145	200	76	134	131	113	95	152	154
1929	135	183	189	133	124	117	92	137	137
1930	77	128	131	123	93	76	93	98	129
1931	46	82	66	83	50	44	73	40	115
1932	52	105	55	62	50	43	52	46	102
1933	82	130	118	79	81	84	68	57	91
1934	100	213	64	91	127	96	111	146	95
1935	90	184	85	80	102	94	63	135	119
1936	100	236	164	106	163	116	94	148	104
1937	68	204	76	93	81	109	74	87	110
1938	69	196	80	83	76	64	57	97	88
1939	73	154	100	85	88	78	67	94	91
1940	80	160	78	97	96	77	64	96	111
1941	137	264	116	107	117	107	81	211	129
1942	153	369	168	136	143	124	91	202	163
1943	160	405	188	232	174	154	125	231	245
1944	167	420	214	219	170	160	138	234	212
1945	181	366	205	232	198	170	127	227	224
1946	263	382	175	249	212	209	141	319	204
1947	252	380	224	245	366	273	146	379	249
1948									
December	239	457	220	250	192	232	161	305	209
1949									
January	236	429	238	269	195	229	169	291	282
February	235	295	249	279	174	219	173	237	285
March	232	319	250	290	184	224	168	228	263
April	241	247	260	314	190	226	160	223	236
May	242	325	260	312	190	226	149	224	213
June	243	315	251	301	188	210	138	207	175
July	243	565	222	323	195	206	132	166	185
August	236	446	221	305	184	202	135	197	174
September	240	487	198	263	181	212	137	193	205
October	231	474	187	224	170	214	141	185	170
November	224	434	192	216	159	215	141	188	226

Wholesale Prices of Ammoniates

	Nitrate of soda bulk per unit N	Sulphate of ammonia bulk per unit N	Cottonseed meal S. E. Mills per unit N	Fish scrap, dried 11–12% ammonia, 15% bone phosphate, f.o.b. factory bulk per unit N	Tankage 11% ammonia, 15% bone phosphate, f.o.b. Chicago, bulk, per unit N	High grade ground blood, 16–17% ammonia, Chicago, bulk, per unit N
1910–14	$2.68	$2.85	$3.50	$3.53	$3.37	$3.52
1924	2.99	2.44	5.87	5.02	3.60	4.25
1925	3.11	2.47	5.41	5.34	3.97	4.75
1926	3.06	2.41	4.40	4.95	4.36	4.90
1927	3.01	2.26	5.07	5.87	4.32	5.70
1928	2.67	2.30	7.06	6.63	4.92	6.00
1929	2.57	2.04	5.64	5.00	4.61	5.72
1930	2.47	1.81	4.78	4.96	3.79	4.58
1931	2.34	1.46	3.10	3.95	2.11	2.46
1932	1.87	1.04	2.18	2.18	1.21	1.36
1933	1.52	1.12	2.95	2.86	2.06	2.46
1934	1.52	1.20	4.46	3.15	2.67	3.27
1935	1.47	1.15	4.59	3.10	3.06	3.65
1936	1.53	1.23	4.17	3.42	3.58	4.25
1937	1.63	1.32	4.91	4.66	4.04	4.80
1938	1.69	1.38	3.69	3.76	3.15	3.53
1939	1.69	1.35	4.02	4.41	3.87	3.90
1940	1.69	1.36	4.64	4.36	3.33	3.39
1941	1.69	1.41	5.50	5.32	3.76	4.43
1942	1.74	1.41	6.11	5.77	5.04	6.76
1943	1.75	1.42	6.30	5.77	4.86	6.62
1944	1.75	1.42	7.68	5.77	4.86	6.71
1945	1.75	1.42	7.81	5.77	4.86	6.71
1946	1.97	1.44	11.04	7.38	6.60	9.33
1947	2.50	1.60	12.72	10.66	12.63	10.46
1948						
December	3.00	2.20	11.52	11.65	11.39	11.46
1949						
January	3.15	2.23	10.29	8.68	11.53	11.53
February	3.19	2.27	9.44	12.36	10.78	10.70
March	3.19	2.27	9.27	12.36	9.64	9.71
April	3.19	2.27	9.22	12.36	9.71	9.87
May	3.19	2.27	9.43	12.36	9.71	9.11
June	3.19	2.28	9.65	13.34	10.02	9.71
July	3.19	2.32	11.07	14.97	11.53	10.78
August	3.19	2.32	11.88	14.49	12.75	12.14
September	3.19	2.32	9.83	14.53	11.53	11.53
October	3.08	2.32	9.94	14.58	11.29	11.65
November	3.00	2.32	10.39	10.21	10.39	10.78
Index Numbers (1910-14 = 100)						
1924	111	86	168	142	107	121
1925	115	87	155	151	117	135
1926	113	84	126	140	129	139
1927	112	79	145	166	128	162
1928	100	81	202	188	146	170
1929	96	72	161	142	137	162
1930	92	64	137	141	12	130
1931	88	51	89	112	63	70
1932	71	36	62	62	36	39
1933	59	39	84	81	97	71
1934	59	42	127	89	79	93
1935	57	40	131	88	91	104
1936	59	43	119	97	106	131
1937	61	46	140	132	120	122
1938	63	48	105	106	93	100
1939	63	47	115	125	115	111
1940	63	48	133	124	99	96
1941	63	49	157	151	112	126
1942	65	49	175	163	150	192
1943	65	50	180	163	144	189
1944	65	50	219	163	144	191
1945	65	50	223	163	144	191
1946	74	51	315	209	196	265
1947	93	56	363	302	374	297
1948						
December	112	77	329	330	338	326
1949						
January	118	78	294	246	342	328
February	119	80	270	350	320	304
March	119	80	265	350	286	276
April	119	80	263	350	288	280
May	119	80	269	350	288	259
June	119	80	276	378	297	276
July	119	81	316	424	342	306
August	119	81	339	410	378	345
September	119	81	281	412	342	328
October	115	81	284	413	335	331
November	112	81	297	403	308	306

Wholesale Prices of Phosphates and Potash* *

	Superphosphate Baltimore, per unit	Florida land pebble 68% f.o.b. mines, bulk, per ton	Tennessee phosphate rock, 75% f.o.b. mines, bulk, per ton	Muriate of potash bulk, per unit, c.i.f. Atlantic and Gulf ports[2]	Sulphate of potash in bags, per unit, c.i.f. Atlantic and Gulf ports[2]	Sulphate of potash magnesia, per ton, c.i.f. Atlantic and Gulf ports[2]	Manure salts bulk, per unit, c.i.f. Atlantic and Gulf ports[2]
1910–14	$0.536	$3.61	$4.88	$0.714	$0.953	$24.18	$0.657
1924	.502	2.31	6.60	.582	.860	23.72	.472
1925	.600	2.44	6.16	.584	.860	23.72	.483
1926	.598	3.20	5.57	.596	.854	23.58	.537
1927	.525	3.09	5.50	.646	.924	25.55	.586
1928	.580	3.12	5.50	.669	.957	26.46	.607
1929	.609	3.18	5.50	.672	.962	26.59	.610
1930	.542	3.18	5.50	.681	.973	26.92	.618
1931	.485	3.18	5.50	.681	.973	26.92	.618
1932	.458	3.18	5.50	.681	.963	26.90	.618
1933	.434	3.11	5.50	.662	.864	25.10	.601
1934	.487	3.14	5.67	.486	.751	22.49	.483
1935	.492	3.30	5.69	.415	.684	21.44	.444
1936	.476	1.85	5.50	.464	.708	22.94	.505
1937	.510	1.85	5.50	.508	.757	24.70	.556
1938	.492	1.85	5.50	.523	.774	15.17	.572
1939	.478	1.90	5.50	.521	.751	24.52	.570
1940	.516	1.90	5.50	.517	.730	24.75	.573
1941	.547	1.94	5.64	.522	.780	25.55	.367
1942	.600	2.13	6.29	.522	.810	25.74	.205
1943	.631	2.00	5.93	.522	.786	25.35	.195
1944	.645	2.10	6.10	.522	.777	25.35	.195
1945	.650	2.20	6.23	.522	.777	25.35	.195
1946	.671	2.41	6.50	.508	.769	24.70	.190
1947	.746	3.05	6.60	.498	.706	18.93	.195
1948							
December	.770	4.61	6.60	.375	.720	14.50	.200
1949							
January	.770	4.61	6.60	.375	.720	14.50	.200
February	.770	4.61	6.60	.375	.720	14.50	.200
March	.770	3.85	7.06	.375	.720	14.50	.200
April	.770	3.85	7.06	.375	.720	14.50	.200
May	.770	3.85	7.06	.375	.720	14.50	.200
June	.770	3.66	7.06	.330	.634	12.76	.176
July	.770	3.60	5.87	.353	.679	13.63	.188
August	.770	3.60	5.47	.353	.679	13.63	.188
September	.770	3.65	5.47	.353	.679	13.63	.188
October	.770	3.75	5.47	.375	.720	14.50	.200
November	.770	3.76	5.47	.375	.720	14.50	.200
			Index Numbers (1910-14 = 100)				
1924	94	64	135	82	90	98	72
1925	110	68	126	82	90	98	74
1926	112	88	114	83	90	98	82
1927	100	86	113	90	97	106	89
1928	108	86	113	94	100	109	92
1929	114	88	113	94	101	110	93
1930	101	88	113	95	102	111	94
1931	90	88	113	95	102	111	94
1932	85	88	113	95	101	111	94
1933	81	86	113	93	91	104	91
1934	91	87	110	68	79	93	74
1935	92	91	117	58	72	89	68
1936	89	51	113	65	74	95	77
1937	95	51	113	71	79	102	85
1938	92	51	113	73	81	104	87
1939	89	53	113	73	79	101	87
1940	96	53	113	72	77	102	87
1941	102	54	110	73	82	106	87
1942	112	59	129	73	85	106	84
1943	117	55	121	73	82	105	83
1944	120	58	125	73	82	105	83
1945	121	61	128	73	82	105	83
1946	125	67	133	71	81	102	82
1947	139	84	135	70	74	78	83
1948							
December	144	128	135	68	76	60	83
1949							
January	144	128	135	68	76	60	83
February	144	128	135	68	76	60	83
March	144	107	145	68	76	60	83
April	144	107	145	68	76	60	83
May	144	107	145	68	76	60	83
June	144	101	145	62	67	53	80
July	144	100	120	65	71	56	82
August	144	100	112	65	71	56	82
September	144	101	112	65	71	56	82
October	144	104	112	68	76	60	83
November	144	104	112	68	76	60	83

Combined Index Numbers of Prices of Fertilizer Materials, Farm Products and All Commodities

	Farm prices*	Prices paid by farmers for commodities bought*	Wholesale prices of all commodities†	Fertilizer material‡	Chemical ammoniates	Organic ammoniates	Superphosphate	Potash**
1924.....	143	152	143	103	97	125	94	79
1925.....	156	156	151	112	100	131	109	80
1926.....	146	155	146	119	94	135	112	86
1927.....	142	153	139	116	89	150	100	94
1928.....	151	155	141	121	87	177	108	97
1929.....	149	154	139	114	79	146	114	97
1930.....	128	146	126	105	72	131	101	99
1931.....	90	126	107	83	62	83	90	99
1932.....	68	108	95	71	46	48	85	99
1933.....	72	108	96	70	45	71	81	95
1934.....	90	122	109	72	47	90	91	72
1935.....	109	125	117	70	45	97	92	63
1936.....	114	124	118	73	47	107	89	69
1937.....	122	131	126	81	50	129	95	75
1938.....	97	123	115	78	52	101	92	77
1939.....	95	121	112	79	51	119	89	77
1940.....	100	122	115	80	52	114	96	77
1941.....	124	131	127	86	56	130	102	77
1942.....	159	152	144	93	57	161	112	77
1943.....	192	167	151	94	57	160	117	77
1944.....	195	176	152	96	57	174	120	76
1945.....	202	180	154	97	57	175	121	76
1946.....	233	202	177	107	62	240	125	75
1947.....	278	246	222	130	74	362	139	72
1948								
December..	268	262	237	137	94	336	144	72
1949								
January...	268	260	233	136	97	313	144	72
February..	258	257	231	136	99	309	144	72
March....	261	258	231	134	99	290	144	72
April.....	260	258	229	134	99	291	144	72
May.....	256	257	227	134	99	293	144	72
June.....	252	257	223	134	99	304	144	65
July.....	249	256	225	140	100	349	144	68
August....	245	254	222	143	100	372	144	68
September.	249	253	225	138	100	334	144	68
October...	243	251	222	138	98	331	144	72
November.	239	251	221	136	96	321	144	72

* U. S. D. A. figures. Beginning January 1946 farm prices and index numbers of specific farm products revised from a calendar year to a crop-year basis. Truck crops index adjusted to the 1924 level of the all-commodity index.

† Department of Labor index converted to 1910-14 base.

‡ The Index numbers of prices of fertilizer materials are based on original study made by the Department of Agricultural Economics and Farm Management, Cornell University, Ithaca, New York. These indexes are complete since 1897. The series was revised and reweighted as of March 1940 and November 1942.

[1] Beginning July 1949, baled hay prices reduced by $4.75 a ton to be comparable to loose hay prices previously quoted.

[2] All potash salts now quoted F.O.B. mines only: manure salts since June 1941, other carriers since June 1947.

**** The weighted average of prices actually paid for potash is lower than the annual average because since 1926 over 90% of the potash used in agriculture has been contracted for during the discount period. Since 1937, the maximum discount has been 12%. Applied to muriate of potash, a price slightly above $.471 per unit K_2O thus more nearly approximates the annual average than do prices based on arithmetical averages of monthly quotations.**

REVIEWS

This section contains a short review of some of the most practical and important bulletins, and lists all recent publications of the United States Department of Agriculture, the State Experiment Stations, and Canada, relating to Fertilizers, Soils, Crops, and Economics. A file of this department of BETTER CROPS WITH PLANT FOOD would provide a complete index covering all publications from these sources on the particular subjects named.

Fertilizers

"Phosphorus Studies with Vegetable Crops on Different Soils," Agr. Exp. Sta., Ala. Poly. Inst., Auburn, Ala., Bul. No. 268, June 1949, L. M. Ware and W. A. Johnson.

"Fertilizer Studies with Vegetable Crops on Representative Soils in Alabama," Agr. Exp. Sta., Ala. Poly. Inst., Auburn, Ala., Bul. No. 269, June 1949, L. M. Ware and W. A. Johnson.

"Effect of Potash on Oranges—Studies on Deficiency and Excess in Relation to Tree Growth, Composition and Fruit Quality," College of Agr., Univ. of Calif., Berkeley, Calif., reprinted from Calif. Agr. 2(6):3, June 1948, H. D. Chapman, S. M. Brown, and D. S. Rayner.

"State Laboratory Fertilizer, Feed, Limes, and Seed Report, January—June 1949," State Board of Agr., The Green, Dover, Del., Quarterly Bul., Vol. 39, No. 2, June 30, 1949.

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Grow Lespedeza Sericea

(*From page* 14)

Before planting sericea the plots were producing 30 bushels of corn per acre. The land was left in sericea three years and cut annually for hay.

Where seed are to be harvested, the last cutting for hay should be omitted. Seed can be harvested readily with a combine and are usually ready for harvest in November. About the best time for harvest is right after the first heavy killing frost. Seed yields range from 200-600 pounds per acre.

Sericea should be refertilized as often as necessary to maintain quality and quantity of forage. Thin stands can be replenished by allowing plants to seed. Mow after heavy frost, apply 400-600 pounds of 0-12-12 or 3-12-12 fertilizer, and disc lightly.

Fertilizing Vegetable Crops

(*From page* 10)

lished more quickly if a starter solution is applied in transplanting. This is especially true if fertilizer has not been placed in the row. Standard starter solution formulas are high in nitrogen, phosphorus, and potassium. Commercial mixtures should be used according to directions of the manufacturer.

An effective starter stock solution can be made by dissolving 3-12-6 or 4-12-4 fertilizer at the rate of one pound per gallon of water. The fertilizer is suspended in a bag near the top of the water and allowed to dissolve for several hours. This stock solution is placed in the water for transplanting at the rate of 8 to 10 gallons of the solution to 40 gallons of water, so that each 50-gallon tank contains 8 to 10 pounds of actual fertilizer.

Combined methods — Where long-time programs of soil management are involved, and in the growing of long-season crops, such as tomatoes, peppers, eggplants, and sweet corn, two or more methods of applying fertilizer often are combined. In such cases half to two-thirds of the fertilizer may be plowed down by the broadcast or plow-sole method and the remainder applied in bands or as sidedressing during the growing season. For many of the shorter-season market garden crops, half of the fertilizer often is broadcast and plowed down and the remainder applied with a grain drill, placing it about three inches deep after most of the soil preparation has been completed. Further supplementary applications may be made by the band method at planting time.

Concentrated fertilizers—In recent years large quantities of concentrated fertilizer, such as 10-20-10, 6-18-6, and 8-16-16, have become available. These higher analyses, in the same ratio, may be substituted in equivalent amounts for any of the suggested analyses shown in Tables III and IV. High-analysis fertilizers usually can be purchased at less cost per unit of plant nutrients than low-analysis fertilizers. As

Fig. 4. This cabbage transplanter places the fertilizer in bands and applies starter solution.

TABLE III—SUGGESTED ANALYSES AND RATES OF APPLICATION OF FERTILIZER

Crop	Medium loam soils			
	Manure or clover sod		No manure or clover sod	
	Analyses	Pounds per acre	Analyses	Pounds per acre
Asparagus	5–10– 5	1,000	5–10– 5	1,500
Beets, carrots, and other root crops	4–12– 8 5–10–10	1,000 1,000	5–10–10	1,500
Beans: snap and edible soy	3–12– 6 4–12– 4	500 500	5–10– 5 4–12– 4	750 750
Lima beans	4–12– 4 5–10– 5	750 750	4–12– 8 5–10– 5	1,000 1,000
Cucumbers, muskmelons, pumpkins, and squash	4–12– 4	750	4–12– 8 6–12– 6	1,000 1,000
Cabbage, broccoli, and cauliflower	4–12– 4 5–10– 5	1,000 1,000	4–12– 8 6–12– 6	1,000 1,000
Sweet corn	4–12– 4 5–10– 5	400 400	5–10– 5 4–12– 8	400–600 400–600
Celery	4–12– 8	1,000	5–10–10	1,500
Leaf lettuce	4–12– 4 5–10– 5	800 800	5–10– 5	1,000
Head lettuce	4–12– 4	1,000	5–10– 5	1,000
Spinach	4–12– 4 5–10– 5	1,000 1,000	5–10– 5	1,500
Onions	3–12– 6	1,200	4–12– 8	1,500
Peas	3–12– 6	500–700	3–12– 6	750–1,000
Peppers, eggplants	3–12– 6	750	5–10– 5	1,000
Sweet potatoes	4–12–12	800	4–12–12	1,000
Tomatoes	4–12– 4 3–12– 6 5–10– 5	800 800 800	3–12– 6 4–12– 8 5–10–10	1,000 1,000 1,000

an example, 500 pounds of 6-18-6 fertilizer supplies the same amount of plant nutrients as 750 pounds of 4-12-4 fertilizer. Other similar ratios may be substituted where they may be more conveniently obtained or where there is reason to believe they are more desirable.

How to Get the Most Out of Your Fertilizer

1. Choose land well adapted to the

vegetable crop to be grown. Fertilizer is much more likely to give better returns on good land than on poor land.

2. Be sure that the soil is well drained. Do not waste fertilizer by applying it to poorly drained soils.

3. Use enough lime; do not guess. If you are in doubt have soil tested. Soil testing leads to more intelligent liming.

4. Fertilize adequately. Apply fertilizer in a way that will not cause injury but will give highest yields.

5. Cultivate enough to control weeds.

TABLE IV—SUGGESTED ANALYSES AND RATES OF APPLICATION OF FERTILIZER

Crop	Sandy loam soils			
	Manure or clover sod		No manure or clover sod	
	Analyses	Pounds per acre	Analyses	Pounds per acre
Asparagus	5–10–10	1,800	5–10–10	2,000
Beets, carrots, and other root crops	5–10–10	1,800	5–10–10	2,000
Beans: snap and edible soy	5–10– 5 4–12– 8	850 850	5–10– 5 4–12– 8	1,000 1,000
Lima beans	5–10–10 6–12– 6	1,000 1,000	5–10–10 6–12– 6	1,250 1,250
Cucumbers, muskmelons, pumpkins, and squash	5–10–10	1,000	5–10–10	1,250
Cabbage, broccoli, and cauliflower	4–12– 8 5–10–10	1,000 1,000	4–12– 8 5–10–10	1,250 1,250
Sweet corn	5–10– 5 4–12– 8	400–600 400–600	4–12– 8 5–10–10	600–800 600–800
Celery	5–10–10	1,500	5–10–10	2,000
Leaf lettuce	5–10– 5	1,000	5–10– 5	1,500
Head lettuce	5–10– 5	1,000	5–10– 5 6–12– 6	1,500–1,800 1,500–1,800
Spinach	5–10– 5 6–12– 6	1,500 1,500	5–10– 5 6–12– 6	2,000 2,000
Onions	5–10–10	1,500	5–10–10	2,000
Peas	4–12– 8	750–1,000	4–12– 8	1,000–1,500
Peppers, eggplants	4–12– 8	1,000	5–10– 5	1,250
Sweet potatoes	4–12–12	1,000	4–12–12	1,200
Tomatoes	3–12– 6 5–10–10 4–12– 8	1,000 1,000 1,000	5–10– 5 4–12– 8 5–10–10	1,500 1,500 1,500

You cannot grow both weeds and vegetables.

6. Give as much attention to the need for sidedressing vegetables with readily available nitrogen during the growing season as to the need for the initial fertilizer application.

7. Adopt a sound rotation. Follow vegetables with some soil-improving crop, such as ryegrass.

Pacific Northwest . . . Strawberries

(*From page* 24)

ers like to have families move in, with mother, father, and children all picking berries. Many families use this as their annual vacation where all can work, make money, and enjoy a pleasant healthful outing together.

The harvesting in the fields is accomplished by the picker stemming the fruit as it is removed from the plant and then placing it in one-pound hallocks. There are six empty hallocks in a carrier, a small wooden box with a handle extended over the top for carrying in the field. When a carrier is delivered to the field table, the checker takes it and gives the picker an empty one, at the same time punching the picker's record card, giving credit for boxes picked. When the card is full, the picker can turn his card in at the office and receive his pay.

Processing

The berries are trucked to the processing plants, unloaded, and weighed. A sample is taken from each load for inspection. The State Department of Agriculture has inspectors in many of the plants who grade and establish the percentage of No. 1 berries in the lot. The growers are paid on this grade.

Packers process the berries as soon as they are received in order to keep all of the fresh fruit flavor in the product. The strawberries are dumped in water and washed, and come out on a belt where water under pressure is sprayed over them. They then move down grading belts where all off-colored, misshapen, or off-grade berries are removed. Then they are sliced, and sugar is added. They are packed in one pound packages, and placed in a sharp freeze tunnel, where the temperature is 30 to 40° below 0° F. When frozen they are removed, packed in cartons, and held in cold storage ready to be shipped in carload lots to the distributor.

Problems

The concentration of crops in any area always seems to bring trouble. In the early days of strawberry culture, the strawberry root weevil, a destructive pest, almost caused the downfall of the Northwest strawberry industry. The larvae eat the roots during the winter and devitalize the plants. If the insect population is allowed to build up, a field may be completely ruined. Growers were almost out of business when M. J. Forsell, Horticultural Inspector at Everett, Washington, developed "Go West," a poison apple-pomace bait. This timely development put strawberry growing back on a paying basis.

At the present time virus diseases are reducing both the growth of plants and yields; not only in the Northwest but in the East as well. In time these also may be controlled by some easier method than spraying, dusting, and roguing mother-plant beds that are grown in isolation, as is the practice now.

It appears from many years of experience with strawberry growers that it is

of prime importance to plant clean stock, use recommended disease and insect control measures, and to get high production and quality fruit by proper soil preparation and generous use of fertilizers.

Observations of a Fieldman

(*From page* 26)

to pay for a carload of limestone. To this "Uncle Whit" countered, "You say you have some dairy cows. I'd advise you to order the limestone now and then sell some of your cows to pay for the lime when the car arrives." This argument evidently sank in because Mr. Kiefer paid for his first car of limestone by selling one of his best dairy cows. Later he was able to lime his entire farm, and through the years has also put on many tons of phosphate and potash.

Another outstanding example is the Apple Brothers, Leo, Ed, and Paul, who farm near the Enfield experiment field. They started a number of years ago to use lime and legumes on a small farm which they had taken over. Now they have over 400 acres operated as a unit and fully equipped with machinery, substantial buildings, and hog-tight fences. Their main crops are corn, barley, wheat, and clovers. The corn and barley are fed to hogs, with the barley serving as a fall and spring pasture as well as a grain feed. They plow under many acres of sweet clover each year and use in addition large amounts of mixed fertilizers.

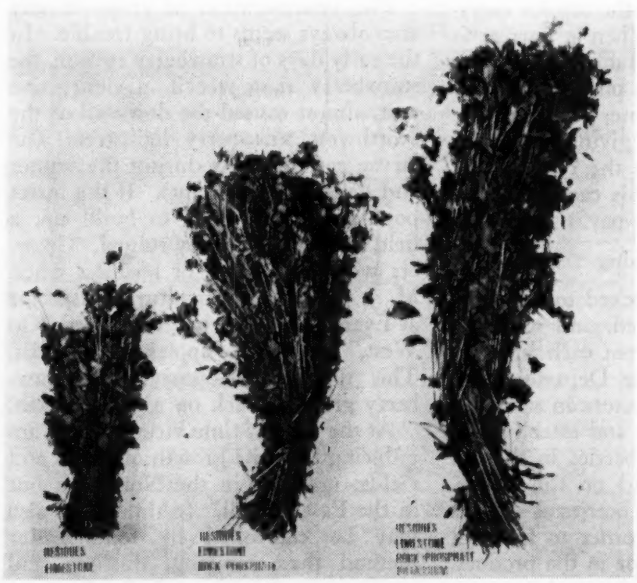

Fig. 2. Alfalfa-red clover grown on the Enfield Experiment Field, 1948. Each bundle represents the growth from a 4-ft. square area under the soil treatments indicated.

Residues	**Residues**	**Residues**
Limestone	**Limestone**	**Limestone**
	Rock phosphate	**Rock phosphate**
		Potassium

The Ewing experiment field, started in 1910, is located on level, gray soils with a rather impervious subsoil. Without soil treatment this land appears hopeless as a farming proposition. When properly treated and under good management, it becomes highly profitable. The soil is very acid and requires four to six tons of limestone an acre. It is deficient in organic matter, necessitating the return of all pos-

sible crop residues, especially legumes. Phosphate and potash also are highly essential on this land. Results such as shown in Table I may be obtained under good management when the soil is properly treated.

The Elizabethtown field, started in 1918, is located on the yellow hill land of extreme southern Illinois. This field affords an excellent demonstration of what may be accomplished on this type of farm land by crop rotation, lime, legumes, phosphate, potash, and general soil conservation practices. The results in Table II indicate that it would scarcely be profitable to farm this land without soil treatment. However, with the proper amounts of limestone, phosphate, and potash, and with legumes plowed under, the crop yields are substantial and farm operation is profitable.

TABLE I. EFFECT OF SOIL TREATMENT FOR 38 YEARS ON THE LEVEL GRAY SOILS OF THE EWING EXPERIMENT FIELD.[1]

	Acre Yields	
	No Fertilization	LPK[2]
Corn	12 bu.	50 bu.
Wheat	3 bu.	31 bu.
Oats	11 bu.	37 bu.
Soybeans	6 bu.	25 bu.
Alfalfa—Red clover	340 lbs.	2,700 lbs.

[1] All crop yields are not averaged for the full 38 years. There were some failures and a change from oats to soybeans in 1945.

[2] L—Limestone, P—Rock phosphate; K—Muriate of potash.

TABLE II. EFFECT OF SOIL TREATMENT FOR 30 YEARS ON THE ROLLING YELLOW HILL LAND ON THE ELIZABETHTOWN EXPERIMENT FIELD.

	Acre Yields	
	No Fertilization	LPK
Corn	12 bu.	48 bu.
Wheat	4 bu.	22 bu.
Oats	6 bu.	42 bu.
Alfalfa—Red clover	80 lbs.	3,500 lbs.

Corn and wheat 30-year average.

Water Erosion Control

(*From page* 20)

ducing soil loss when used on cultivated land. The use of 750 pounds of buckwheat straw per acre as a mulch at Ithaca, New York, reduced the soil loss to less than one-fourth (9). Present indications are that from one to two tons of vegetal cover (dry-weight basis) per acre, uniformly distributed over the ground surface at the time of the storm, are needed for effective protection against raindrop impact.

The adequacy of vegetal cover, produced by the cropping system in use, in absorbing the raindrop impact may be illustrated graphically by comparing a chart which shows the extent of the rainfall hazard by months with another which presents a combination of resistance offered by the soil to the hazard and the amount of protection supplied by the cropping system in use. The difference between the energies exerted by the falling raindrop and the resistance offered by the soil and the amount of these energies absorbed by the vegetal cover present represents the raindrop hazard remaining to be dealt with.

The adequacy of the vegetal cover produced by the crop or crops in use, in controlling raindrop impact, is illustrated in Figure 5 (10). The chart in the upper part of the figure shows the raindrop hazard by months, as

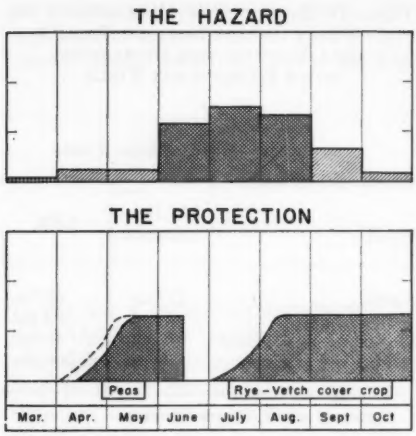

Fig. 5. Schematic outline illustrative of a gap in the protection provided by a crop in a rotation and the following winter cover crop.

measured by the number of excessive rains, for the period March-October, inclusive. The months omitted from the chart had no excessive rains recorded. The chart in the lower half of the figure indicates the estimated protection against the raindrop impact supplied by the foliage of the crops used in the rotation, and which occupy the ground during the same period of the year.

It may be seen that the major rainfall hazard occurs during the months of June-August, inclusive, with a fairly high degree also coming in September. The peas which occupy the ground the first part of the year supply adequate protection during May and the first half of June. However, the peas are harvested for canning and the top growth removed from the field at the beginning of the high rainfall hazard period, June-August. The removal of the peas exposes the bare ground to the impact of the falling raindrop until the cover crop of rye-vetch can be established and produce sufficient cover to absorb the energy of the falling raindrop. Since the cover crop is not seeded until July and some weeks elapse after the planting date before adequate vegetal cover is produced, the land is without satisfactory protection during the major part of the period mid-June-August. It can be safely assumed that at no time after the peas are harvested is there sufficient vegetal cover to provide effective protection to the ground against the ravages of falling raindrops during this period. From this, it is evident that the crop-

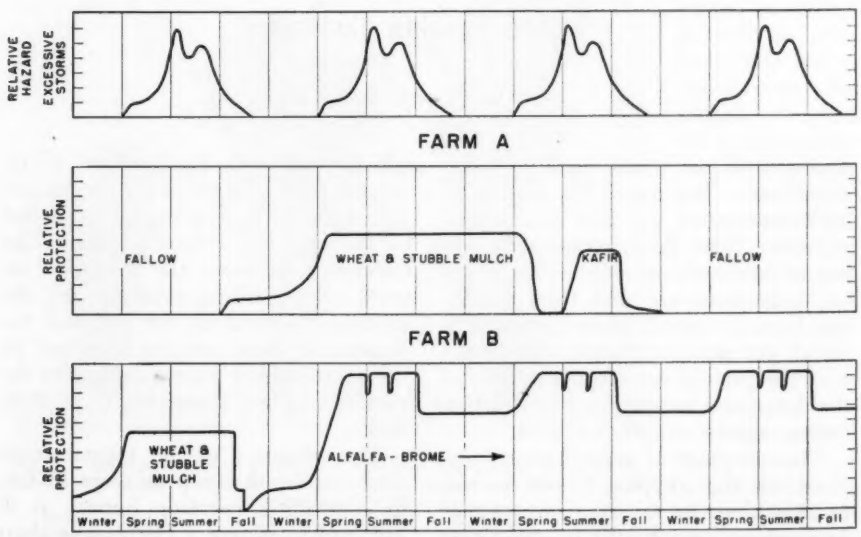

Fig. 6. Schematic outline illustrative of the occurrence of the hazard (excessive storms) and the protection (obtained from agronomic practices) on two different farms in the same area during a 4-yr. period.

ping system in use does not meet the requirements of a conservation cropping system.

The same method may be used in determining whether or not a given crop rotation possesses the requirements of a conservation rotation. In order to accomplish this, however, it is necessary to prepare the two charts so they will cover the full period of time occupied by the rotation. The rainfall hazard chart will be the same for each year of the rotation but the protection chart should reflect the protection provided by the crops used in the rotation during each season of each year of the rotation. This is illustrated graphically in Figure 6, by the use of two distinct types of crop rotations which have the same rainfall hazard (10).

The rainfall hazard begins in early spring and increases steadily until it reaches a peak in June. It declines somewhat after reaching a peak in June but remains high throughout the summer. It declines gradually during the early fall and disappears the latter part of the season. Farm A is cropped to a 4-year rotation consisting of fallow-wheat-kafir-fallow. The two fallow years provide no protection against the raindrop impact except what little is provided by kafir stubble during the second year. The wheat year, when stubble mulch tillage is practiced, provides fair protection throughout the year whereas, the kafir does not develop any degree of protection until after the peak of the rainfall hazard has been reached and passed. The maximum protection supplied by the kafir during the latter part of the summer is inadequate.

The 4-year rotation practiced on farm B supplies protection much superior to that on farm A. Again a 4-year rotation is used but this time it consists of one year of wheat and 3-years of alfalfa-bromegrass hay. Stubble mulch tillage is practiced during the wheat year and, as a result, fairly adequate cover protection is supplied during the entire rainfall hazard period. The alfalfa-bromegrass hay supplies ample protection during the last three years of the rotation.

It is evident that the cropping system shown in Figure 5 and the 4-year crop rotation used on farm A in Figure 6, fail to supply the vegetal cover needed to protect the soil against the ravages of the falling raindrop. Under field conditions it may be found impossible or impractical in many instances, especially where row crops are used in the rotation, to develop crop rotations which will, in themselves, provide the necessary cover in adequate amounts at the proper time. In such cases the crop rotation must be supplemented by the use on the ground surface of crop residues and mulches, if raindrop splash is to be controlled.

Control of Surface Flow

That portion of the rainfall which does not find its way into the soil by percolation, or is not impounded in depressions on the surface of the ground, or is not intercepted by the plant canopy, escapes from the field as surface runoff. As has been stated previously, the chief role of surface flow in the erosion process, before concentrating into rills and gullies, is transporting soil material. It has been stated also that soils which are protected from splash erosion by falling raindrops are not apt to undergo serious erosion as a result of surface flow of excess water from the area.

The force of surface flow is applied more or less horizontally across the surface of the ground. The amount of force generated by surface flow is definitely related to the concentration and velocity with which it moves down slope. The secret of reducing the damage caused by surface flow, then, is to control its concentration, and to retard, or regulate, its velocity.

When runoff water from one small area is allowed to run straight down the slope, it joins with the runoff water from other areas and soon attains great volume as well as high velocity. Since

an acre-inch of water weighs more than 113 tons and the ability of flowing water to move objects varies approximately with the sixth power of its velocity, it is easy to realize the tremendous power exerted by runoff water and visualize what is required to stop a load of this magnitude once it gets under way. Doubling the degree of slope increases the total soil loss 2.8 times (16). It is small wonder that tons upon tons of topsoil may be rolled, or suspended and carried from a cultivated field, leaving eventually but a small amount of either soil or moisture on the field for plant growth.

The regulation of both the concentration and velocity with which free water moves over the surface of the ground may be accomplished by controlling the length of slopes over which the water moves. Where slopes are sufficiently steep, or long, to favor damaging concentrations and velocities, they need to be shortened by establishing appropriate mechanical barriers at strategic distances. The most popular mechanical barriers now in use for shortening slopes include the terrace, contour cultivation, and contour strip-cropping.

Fig. 7. Plant covers protect the soil against the blast of the falling raindrop and serve as a cushion to absorb the raindrop's energy. The water then reaches the surface without any damaging effects to the soil.

By terracing, the field slope is divided into several small watersheds. The short slopes thus formed, plus the use of a cropping plan, soil treatment, and cultural practices fitted to that field, will allow only a minimum of runoff water to attain scouring velocity. By controlling the velocity practically all of the soil is kept on the field and more runoff water may be absorbed as it moves slowly from the field.

Types of Terraces

On the basis of the primary functions of terraces, they may logically be divided into two types or classes, level and graded. Both types are alike in that they are used to control water and save soil but differ in that the level terrace is used to conserve moisture, whereas the graded terrace is used for the orderly disposal of surplus water during times of excess rainfall. Since one of the major functions of the level terrace is the conservation of moisture, its use naturally would be restricted to those areas where the rainfall is inadequate for maximum crop growth and where conservation of moisture is of primary importance. The graded terrace, on the other hand, is recommended for humid conditions where conservation of moisture is not a major factor as a rule.

Contour strip-cropping is the growing of a soil-exposing crop such as corn, cotton, or potatoes in relatively narrow strips across slopes on the level, or contour, alternated with strips of soil-protecting meadow, or small grain crops seeded in meadow mixtures. One of the functions of the strip of sod-producing crops in a strip-cropping system is to retard runoff and catch any soil eroded from the cultivated strip. The vegetal cover also impedes surface flow. This results in much of the soil material carried in suspension being deposited on the sod strip. Various width strips of the soil-conserving crops are effective in reducing erosion and decreasing the distance of soil movement

Fig. 8. Wheat stubble and other crop residues, when left on the surface of the ground, protect the soil against the blasts of the falling raindrops. Soil particles not torn loose by raindrop impact are not apt to suffer any serious erosion.

on between-terrace slopes (3). Under some conditions little or no soil moves from cultivated strips while under other conditions large colluvial fans accumulate in meadow strips (8). Some of these colluvial fans are of sufficient size and extent to indicate that there is continuous severe erosion from the cultivated strip, and in consequence the quantity of vegetation in the meadow strip decreases and its quality deteriorates. The volume and distribution of the colluvial fans appear to be affected by variations in physiographic, pedalogic, and agronomic factors.

Contour cultivation, when properly used under appropriate and applicable conditions, is one of the most effective mechanical ways of saving both soil and water on cultivated land (14). It is effective from the standpoint of increasing crop yields, reducing runoff, and in preventing erosion losses. Like other conservation measures, it has its limitations and maximum results may be expected only when used in conjunction with other erosion control practices. In some areas contour cultivation should be supplemented with terracing. In the humid areas diversion ditches and strip-cropping on certain types of slopes may be necessary. Grassed waterways are useful to protect the field against needless gullying.

Factors, such as soil type and soil condition, amount and intensity of rainfall, the length, irregularity, and steepness of slope, all modify the effectiveness of contour cultivation. In semi-arid areas where the conservation of moisture is of primary importance contour cultivation by listing may be sufficient during periods of heavy rainfall for the orderly disposal of surplus water, or in the semi-arid areas for the conservation of moisture. It is in those areas where contour cultivation serves this double function that appropriate supplemental measures are essential for maximum results.

Information now available indicates that maximum results can be had only by fitting the control measures to the land. This usually calls for various combinations of appropriate cropping systems, contour strip-cropping, terracing and contour cultivation. The three probably should be considered as companion practices in those areas where they are adapted (15).

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Good Will

(*From page* 5)

in winter—just as the taxes and fuel bills jolt our resources.

Yet all these are minor things to put alongside the bigger theme, which is to remind us all that we really have a share in social welfare—even if we miss half the fun of it by having all the services done for us by professionals.

The community chest idea is a good and useful thing to have happen to your town, yet there's one angle to it that hurts good will of a spontaneous kind. I know some geezers who believe that when they have dug up a few dollars a year and received a ticket stub to prove they are donors, it means the end of the business for them. They prefer to assume no further responsibility. You couldn't get them to lug a Christmas basket to a poor family or lift a poor, crippled charity child into a car for a pleasure ride, or wave a finger to gesture good will in any direction—except to clink the cocktail glasses or the tom-and-jerry mugs.

Yet despite that side which deprives a man of the experience of turning good willed on his own hook, the net result to the kids and the other neglected ones by virtue of the modern welfare movement is something to be proud of after all. For in the long run the best kind of professional improvers and supervisors know how to avoid some

very awkward errors in passing out good will.

This is partly because some folks who are supposed to get the benefit of all this largess of the heartstrings are poor receivers and go right out and do the naughty things which your streak of good will was aimed to prevent or discourage or make unnecessary.

IF we were as patient as the Creator and as wise as Solomon and as prudent as Paul, we might get through such a disappointing reaction without tarnishing our meager stock of good will. But most of us just "ain't" built to withstand a shock to our vanity and charity. We just lack the same tolerance with a human failure that we accept when some mechanical gadgets bust in our faces.

However, when all's said and done, it's the folks with good will who lived with us in past years who give us the biggest reinforcement to our faith in the basic kindness of man.

I remember about a rather forlorn foreign family who settled in our community on a small rented place. Few visited them or paid much attention to their presence among us, until one winter we had a severe epidemic of fever which swept the countryside and taxed the utmost skill of the doctors. The humble wife and mother in this immigrant family was a practical nurse, maybe a trifle better than the ordinary in that she had served in emergencies with good physicians in her homeland. Although two of her sons were ill, this woman volunteered to go out into the neighborhood through most of that winter, nursing the sick and keeping the families fed whenever the housewives themselves were stricken. Thus she ran a local "Red Cross" relief service of her own and even pressed into service some of the more apt young women she was able to recruit.

My father had a near neighbor, big, handsome, powerful, and genial, who made up many times in kindness for what he surely lacked in education or knowledge of current affairs and big social movements and issues. He couldn't argue about tariffs or the workmen's compensation law or immigration quotas or dissect the platforms of the political parties—all of which were favorite evening topics around our local firesides. Yet whenever we had livestock troubles—like an animal becoming cast or a cow in difficult calving—or when there was a huge stump or knotty tree to fell, or a stone to load on the drag sled, he seemed to appear from nowhere to lend a mighty arm with a booming word of encouragement and a wide, disarming smile. That man was a real shining knight in blue denim armor to father and me, and when he moved away in search of a better landlord and a better farm we at least knew that his new neighbors would profit by our loss.

TO this day and age I often muse about A. J., as we called him. I haven't seen him for thirty years. He's either old and wrinkled or living beyond irksome farm chores and rural dilemmas, where in the latter case he is probably oiling the big hinges of Peter's golden gate or helping the angels build "them shining stairs."

Connecting our hamlet and a larger city sixty miles northward there ran a rusty single track accommodation line railway when I was a kid. Its entire length passed through farming lands, most of them poor and profitless places, so that the routine passenger traffic thereon was made up of people of small means and rather grubby outlook. The saving grace of that lonesome line was the good will of the conductor, who bossed that slow-motion outfit during all of a quarter of a century. His company paid him meagerly and his uniform was always shiny and baggy. But in courtesy to old ladies and to women with infants, to strangers on their first dreary ride, to kids going away from home, to folks in mourning, and to a few who were weak and ailing—in these

thoughtful attentions he was unique. To their credit let it be said that every community on the line gave him a royal send-off on his last day's run.

Your community and mine also enjoyed the cheerful dependability of a rural doctor, whose annals invariably included weariness and self-sacrifice, long cold rides and midnight vigils spent in tense battles with disease and infected wounds long before these modern wonder-working drugs were his to command. Here again there have often been public testimonials of appreciation given by two or three generations of folks at whose birthday advent he presided. When they pass out gold medals for good will, I am afraid that the country doctors will be entitled to all of the first edition which is cast.

SAD as some things remain in this "vale of sorrow" and worldly care, one finds countless traces of simple good will on every hand, not only in our own quiet haven but in taking ambitious journeys to other states and other lands beyond the seas.

In a strange street where everyone talks in foreign tongues, it is a bright and happy feeling to have a chance passer-by respond to your inquiry about directions or particular sights, and even to have that kindly stranger run off and find another a block or two away —that other citizen being able to understand you and reply in broken but clear English words.

It is very good indeed to return and find a hearty Irish youth presiding at the touchy customs desk, who tells you to take it easy and not be flustered by red tape and fine type documents, and who just lifts your suitcase lid and says, "It's pretty full all right and it gets worse as you go down, so never mind the routine and get going home." (I surmise, however, that his good will doesn't always mar his judgment or blind him to making strict search where search is advisable.)

Over and beyond our personal remembrances of such treasured incidents of good will as we have partaken ourselves there is a whole literature and tradition which clings to good will and underscores the greatest human lives our world has ever known. These folks of wide renown have earned it, and although most of the better ones are not famous for conquest or victory in battle, it is also true that many an act of good will has brightened and humanized the horrid scenes of strife and siege on land and sea.

IN fact, it is that element of good will and fraternal spirit which creates and sustains comradeship among those of our kindred who spent part of their lives in war-time services.

Just as you, too, have your list of local exponents of good will worthy of fond remembrance, I also have a few names to give among scores who might be mentioned as public benefactors against stiff odds and even danger.

We would name Madame Curie of radium fame, Louis Pasteur of bacteria renown, Jane Addams of Chicago's Hull House, General Booth of the Salvation Army, Mahatma Gandhi, soulful thinker, and Walter Reed, who gave his life in conquest of yellow fever.

I leave you to fill in your own list to add to these scanty examples. Every day brings evidence of fresh outpourings of good will. You can't miss seeing or hearing them if you stay alert and responsive. But on the other hand, if we stumble along bent over our own intimate troubles and perplexities and never look around or exchange a grin —then the chance of catching someone performing a deed of good will is not so good.

Queer isn't it about good will? To be able to know it when it happens and be thankful it did occur, you have to keep a little assorted stock of it in your own make-up.

Merry Christmas to you and yours along with a very Happy New Year, for the times and the chimes sing Good Will.

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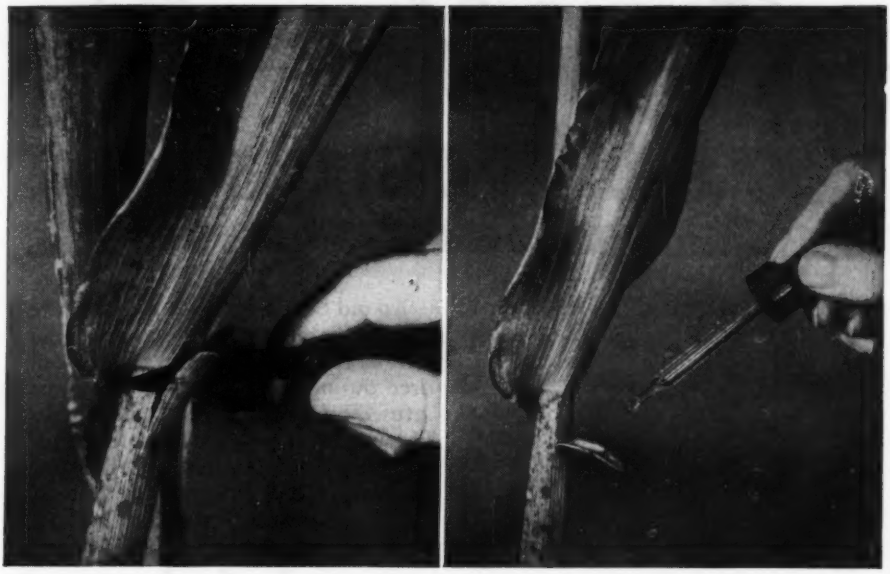
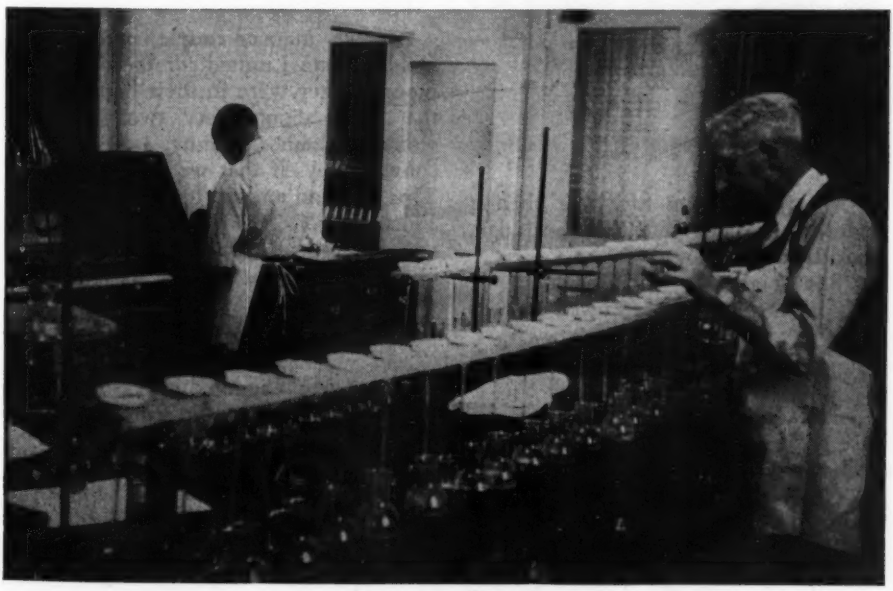


Nitrate tests can be made at the base of the leaf midrib without destroying the entire plant. This is an important consideration in making numerous tests on small experimental plots. The height of the plant at which nitrates are present as well as the intensity of the blue color gives an indication of the nitrate status of the plant.



Equipment used in a well-developed laboratory for soil analyses.

After-Dinner Speaking—An occupation monopolized by men. Women can't wait that long.

* * *

Three salesmen were sitting in a tavern, having a few rounds of beer.

"I hate to see a woman drink alone," said the liquor salesman.

"I hate to see a woman eat alone," added the grocery salesman.

The mattress salesman remained quiet, like a gentleman.

* * *

"Can I be of any assistance?" asked the sympathetic motorist of a man who was looking unutterable thoughts at a disabled car.

"How is your vocabulary?"

"I'm a minister, sir."

"Drive on."

* * *

"We were happy for more than a year," the tearful wife told the judge, "and then the baby came."

"Boy or girl?" asked his honor.

"Girl—a blonde; she moved in next door."

* * *

Little Bobbie tripped and fell on his face on the sidewalk. An elderly lady rushed over to help him to his feet.

"Now, little boy, you must be brave about this," she purred. "You mustn't cry!"

"Cry, my foot," replied Bobbie. "I'm going to sue the hell out of somebody!"

An old Scotch bachelor received a request from an organization in London to take care of a dozen evacuated children during the blitz. The Scotchman refused on the basis that he hated kids. He was then asked to house six expectant mothers instead. "All right," the Scot replied, "but the gals mustn't expect too much. I am past 70 years."

* * *

The maid was asked if she had hung up any mistletoe this Christmas.

"Not me," she replied. "I got too much pride to advertise for the ordinary courtesies a lady has a right to expect."

* * *

A newly married couple boarded the Golden State Limited for their honeymoon. They were in their berths and the bride about every two minutes would exclaim: "Johnny, I just can't convince myself that we are married." This went on and on for half an hour. Finally a voice from the other end of the car shouted, "Johnny, will you convince her so that we all may go to sleep?"

* * *

When people ignored his "No Swimming" signs, a man posted this sign: "Although Labidesthes Sicculus Abounds in This Water, It Gives No Warning of Its Presence." The swimming stopped.

Labidesthes Sicculus is the scientific name of a small fish usually called silversides.

FERTILIZER BORATES

a "A NEW HIGH GRADE" *product*

1—FERTILIZER BORATE, HIGH GRADE—
a highly concentrated sodium borate ore concentrate containing equivalent of 121% Borax.

2—FERTILIZER BORATE—a sodium borate ore concentrate containing 93% Borax.

Both offering economical sources of BORON for either addition to mixed fertilizer or for direct applications where required

Each year larger and larger acreages of our cultivated lands show evidences of Boron deficiency which is reflected in reduced production and poorer quality of many field and fruit crops. Agricultural Stations and County Agents recognize such deficiencies and are continually making specific recommendations for Boron as a minor plant food element.

Literature and Quotations on Request

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Division of Borax Consolidated, Limited

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AGRICULTURAL OFFICES:

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THE PLANT SPEAKS

A new four-reel series of 16 mm., sound, color films which may be booked independently or in any combination. They may be used to best advantage when shown at least one day apart and in the following sequence:

THE PLANT SPEAKS THRU DEFICIENCY SYMPTOMS pictures soil depletion, erosion, and deficiency symptoms on plants. (Running time 25 min. on 800-ft. reel.)

THE PLANT SPEAKS, SOIL TESTS TELL US WHY depicts taking soil samples on the farm and the interpretation of soil tests. (Running time 10 min. on 400-ft. reel.)

THE PLANT SPEAKS THRU TISSUE TESTS shows the value of tissue testing and the procedure for testing plant tissues in the field. (Running time 14 min. on 400-ft. reel.)

THE PLANT SPEAKS THRU LEAF ANALYSIS evaluates leaves in plant growth and leaf analysis in determining fertilizer needs. (Running time 18 min. on 800-ft. reel.)

We shall be pleased to loan these films to agricultural colleges, experiment stations, county agents, vocational teachers, responsible farm organizations, and members of the fertilizer trade.

OTHER 16MM. COLOR FILMS AVAILABLE FOR TERRITORIES INDICATED

Potash in Southern Agriculture (South)
In the Clover (Northeast)
Bringing Citrus Quality to Market (West)
Machine Placement of Fertilizer (West)
Ladino Clover Pastures (West)
Potash from Soil to Plant (West)
Potash Deficiency in Grapes and Prunes (West)
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Potash Production in America (All)
Save That Soil (All)
Borax From Desert to Farm (All)

IMPORTANT

Requests should be made *well in advance* and should include information as to group before which the film is to be shown, date of exhibition (alternative dates if possible), and period of time of loan.

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